SWRI SURFACE WATER RESOURCES, INC.

AG/URBAN CAUCUS

AG/URBAN TECHNICAL TEAM REPORT

ON THE

POTENTIAL WATER SUPPLY BENEFITS

OF THE

THRU-DELTA AND DUAL WATER TRANSFER ALTERNATIVES

AUGUST 21, 1997

SWRI SURFACE WATER RESOURCES INC

MEMORANDUM

To: Ag/Urban Caucus Technical Team

From: Dave Schuster

Date: August 21, 1997

Subject: Water supply and fishery benefits of the Thru-Delta and 7,500 cfs Dual water transfer facilities.

The purpose of this memorandum is to summarize what we have learned from the many operation studies that have been done and to do that in a way that will assist the Ag/Urban Caucus make a decision on a preferred Delta water transfer alternative.

Actual and possible future water supplies assuming existing Delta water transfer facilities:

The first step in this process is to fully describe the current and potential future water supply reliability for the Central Valley Project (CVP) and State Water Project (SWP) water users. We have two studies that define the current and potential future CVP and SWP water supply reliability which are:

1) The amount of water available to the CVP and SWP measured in total project exports assuming a) the Delta Accord Bay-Delta water quality standards; b) the 1993 winter-run biological opinion upper Sacramento River temperature requirements; c) the current U.S. Bureau of Reclamation (USBR) New Melones Project operation plan and the FERC Tuloumne River minimum fishery requirements on the San Joaquin River; and d) the current USBR/U.S. Fish & Wildlife Service (F&WS) AFRP minimum fish release requirements downstream of Nimbus and Keswick dams. (See Table I)

2) The potential amount of water available to the CVP and SWP in the future if no Delta water transfer solution is implemented and the Delta Accord Bay-Delta water quality standards are changed in the future due to Endangered Species Act (ESA) listings and/or State Water Resources Control Board (SWRCB) actions. (See Table II)

The water quality standards used for study two above were developed by considering a) the F&WS list of the thirteen proposed Delta actions, b) the biological issues not resolved during the Delta Accord through scientific discussions because of the large water supply cost of each issue, and c) California Department of Fish and Game (DF&G) staff proposed changes to the Delta Accord Bay-Delta water quality standards. The judgement, made by Hanson and I, as to which of the above issues might be implemented in the future was based on the following:

- Some proposed actions were eliminated because there was little, if any, scientific basis behind the proposal.

- Eliminated some actions, such as those proposed for striped bass, that are a) likely not required because of the benefits provided by the Delta Accord Bay-Delta water quality standards, b) are probably not required because the species population seems to be controlled by factors other than project operations such as Delta inflow quality and/or food source limitation, and c) because the species is of lesser priority because it's a non-native species.

- Included actions that in our judgement had a sufficient biological basis, given current available biological information, or lack of information, to be implemented through a regulatory process such as ESA and/or the SWRCB.

Clearly, predicting possible future conditions is a matter of judgement. However, the second study provides one possible future case that is not a "the sky is falling" case but one that could happen if the current conflicts with Club FED agencies erupt and there is no Delta solution plus habitat improvements being implemented today and will be implemented in the future are insufficient to prevent "take" of delta smelt and ESA listing(s) of spring-run salmon, steelhead, Sacramento splittail, and/or San Joaquin River fall-run salmon. The actions added to the Delta Accord Bay-Delta water quality standards by the Technical Team for analysis are increased (more severe) export constraints in the spring, higher transport flows in the Sacramento River below Freeport, additional days of Delta Cross Channel gates closures in the fall, and increased export constraints in the fall. All of these actions are proposed in F&WS current b(2) water proposed actions. (The possible future water quality standards used in study are attached as Table A.)

<u>Results</u>:

All benefits or impacts of Thru-Delta and Dual water transfer facilities are measured against the Delta Accord base (Table I). That base study attempts to meet a combined CVP and SWP south of the Delta demand of about 7,000,000 AF. The base shows that the average annual export level during the 1922-92 period was only 83% of the 7,000,000 AF demand target, 66% of the target during the 1986-92 drought, and 64% during the 1928-34 drought.

Should CALFED fail and the past fights return relative to the competition for a limited water supply between fishery needs and water user need, a possible future base represented by study 2 could become a reality. That possible future base (Table II) results are that the average annual export level during the 1922-92 period was only 79% (-242,000 AF from Delta Accord base) of the 7,000,000 AF demand target, 63% (-237,000 AF) of the target during the 1986-92 drought, and 58% (-502,000) during the 1928-34 drought.

Conclusion: The existing CVP and SWP water supply is not reliable and could be reduced significantly if a Delta solution is not found and the water wars continue.

Thru-Delta Water Transfer Facilities:

Studies have been conducted on a Thru-Delta water transfer alternative. The assumed facilities include a pumping plant and fish screen at Hood, enlarged channels in the north and south Delta to provide channel capacity for moving water diverted at Hood to the export pumps in the south Delta, a significant quantity of improved (new) habitat, and an additional Clifton Court Forebay intake.

We conducted two studies to determine the water supply benefits of the Thru-Delta water transfer facilities which are described below:

1) Delta operation criteria for a Thru-Delta water transfer alternative that included all of the criteria used in the potential future worst case with existing water transfer facilities study plus criteria on the amount (%) of Sacramento River that can be diverted at Hood. Results of this study are shown in Table III.

2) The above operation criteria was used except the Delta outflow requirements (X2) were adjusted to account for the environmental benefits provided by the Thru-Delta alternative. Specifically, 1) the elimination of entrainment impacts in the lower San Joaquin River and downstream; and 2) assumed habitat improvements from Suisun Bay upstream to Collinsville (The operation criteria used is shown in Table B). Results of this study are shown in Table IV.

<u>Results</u>:

The results from the first study show that the Thru-Delta alternative would provide no water supply benefit when compared to the <u>Delta Accord base</u> (Table III). However, this study does show that all of the worst case base Delta operations requirements can be met with no water cost if the Thru-Delta alternative is constructed. If the worst case base is used to calculate the potential water supply benefits of this study, the results would be:

Total CVP & SWP Exports
Thru-Delta Water Transfer Facilities
Delta Accord Water Quality Standards +

Period	Average Annual Exports (TAF)	Difference from the Base (TAF)
1922-92	5,782	233
1928-34	4,509	502
1986-92	4,711	302

The results from the second study show that if the Delta outflow requirements are changed, as shown in Table B, the Thru-Delta alternative would provide significant water supply benefits during droughts (160,000 AF per year during the 1928-34 drought and 177,000 AF per year during the 1986-92 drought) and little benefit outside of multi-year droughts when compared to the Delta Accord base. If the worst case base is used to calculate the water supply benefits of the second study, the results would be:

Total CVP & SWP Exports
Thru-Delta Water Transfer Facilities
Delta Accord Water Quality Standards +
with Adjusted Delta Outflow Requirements

Period	Average Annual Exports (TAF)	Difference from the Base (TAF)
1922-92	5,827	278
1928-34	4,652	662
1986-92	4,837	414

Conclusion: The Thru-Delta water transfer alternative provides the two projects increased operational flexibility that allows the project to provide significant increased Bay-Delta environmental protection with no negative impact on CVP and SWP water supplies. That fact results in significant improved water supply certainty and, therefore, greater reliability. The increased operational flexibility provided by the Thru-Delta water transfer alternative is solely due to increasing SWP export capability to 10,300 cfs. The Thru-Delta water transfer alternative provides no increased SWP and CVP water supply unless the Delta outflow requirements are reduced.

Because the Thru-Delta alternative involves continued pumping from the south Delta exclusively, the water supply benefits discussed above could be reduced because of the effect of delta smelt "take" limit operational adjustments.

Dual Water Transfer Facilities:

Studies have been conducted on a Dual water transfer alternative. The assumed facilities include a pumping plant and fish screen at Hood, a 7,500 cfs unlined canal from Hood to Clifton Court Forebay, a significant quantity of improved (new) habitat, and a connecting channel from Clifton Court Forebay and the Tracy Pumping Plant intake channel.

We conducted two studies to determine the water supply benefits of the Dual water transfer facilities which are described below:

1) Delta operation criteria for a Dual water transfer alternative that included all of the criteria used in the potential future worst case base with existing water transfer facilities study plus criteria on the amount (%) of Sacramento River that can be diverted at Hood. Results of this study are shown in Table V.

2) The above operation criteria was used except the Delta outflow requirements (X2) were adjusted to account for the environmental benefits provided by the Dual alternative (The operation criteria used is shown in Table C). Specifically, 1) the significant reduction of entrainment impacts in the lower San Joaquin River and downstream to the confluence of the Sacramento and San Joaquin rivers (Collinsville) during periods important to the fishery; and 2) assumed habitat improvements from Suisun Bay upstream to Collinsville. Results of this study are shown in Table VI.

Results:

The results from the first study show that the Dual water transfer alternative would provide an average annual water supply benefit of about 90,000 AF and slightly more than that during drought periods when compared to the Delta Accord base (Table V). In addition, this study results show that all of the worst case base Delta operations requirements can be met with no water cost if the Dual water transfer alternative is constructed. If the worst case base is used to calculate the potential water supply benefits of this study, the results would be:

Total CVP & SWP Exports - 7,500 cfs
Dual Water Transfer Facility
Delta Accord Water Quality Standards +

Period	**Average Annual Exports** (TAF)	**Difference from the Base** (TAF)
1922-92	5,878	329
1928-34	4,628	597
1986-92	4,796	362

The results from the second study show that if the Delta outflow requirements are changed, as shown in Table C, the Dual water transfer alternative would provide significant water supply benefits (380,000 AF per year during the 1928-34 drought, 280,000 AF per year during the 1986-92 drought, and 140,000 AF per year during the 1922-92 period) when compared to the Delta Accord base. If the worst case base is used to calculate the water supply benefits of the second study, the results would be:

Total CVP & SWP Exports - 7,500 cfs
Dual Water Transfer Facility
Delta Accord Water Quality Standards +
with Adjusted Delta Outflow Requirements

Period	**Average Annual Exports** (TAF)	**Difference from the Base** (TAF)
1922-92	5,929	381
1928-34	4,855	879
1986-92	4,944	516

Conclusion: The Dual water transfer alternative provides the two projects increased operational flexibility that allows the project to provide significant increased Bay-Delta environmental protection with no negative impact on CVP and SWP water supplies. That fact results in significant improved water supply certainty and, therefore, greater reliability. The increased operational flexibility provided by the Dual water transfer alternative is due to increasing SWP export capability to 10,300 cfs and the ability to export either at Hood, the south Delta, or both. The Dual water transfer alternative provides limited increased SWP and CVP water supply if the Delta outflow requirements are not reduced and significant water supply benefits if the outflow requirements are reduced.

The multiple diversion locations significantly improves the projects ability to address delta smelt "take" problems. This means the calculated water supply benefits for the Dual water transfer alternative are very firm and will not likely be reduced due to "take" limit export reductions as occurs currently and would occur with the Thru-Delta alternative.

Additional Information:

Frequency curves are attached to show the distribution of the benefits supplied under the various assumptions described above. The information offered is:

Figure 1 - Total exports for the Thru-Delta alternative for the Delta Accord Base, Thru-Delta with no Delta outflow adjustments, and Thru-Delta with Delta outflow adjustments.

Figure 2 - Total exports for the Dual alternative for the Delta Accord base, Dual with no Delta outflow adjustments, and Dual with Delta outflow adjustments.

Figure 3 - Total exports for the Thru-Delta alternative for the possible worst case base, Thru-Delta with no Delta outflow adjustments, and Thru-Delta with Delta outflow adjustments.

Figure 4 - Total exports for the Dual alternative for the possible worst case base, Dual with no Delta outflow adjustments, and Dual with Delta outflow adjustments.

Fishery Benefits:

The water users think of additional (above the Delta Accord standards) operational constraints proposed to be imposed on the projects as either reducing their existing water supply or reducing the potential benefits of new Delta water transfer facilities. The other side of that coin is that those proposals, if implemented, will provide real fishery benefits or, at least, real benefits from the CALFED fishery biologists perspectives. These are the same agencies the Ag/Urban Caucus will have to negotiate an agreement with on Delta operation criteria for the Thru-Delta or Dual water transfer alternatives.

Model output can be used to describe some of those benefits. Attached are figures showing the changes to south Delta pumping, X2 position, flows at Rio Vista, and flows at Antioch for the Thru-Delta and Dual alternatives.

Full analysis of this information would require another long memorandum and more expertise that I have. Briefly, however, these figures show:

- The Thru-Delta alternative reduces the pumping from the south Delta during the key late winter and spring months.
- The Thru-Delta alternative increases the pumping from the south Delta during the November through January period.
- The Dual alternative reduces the pumping from the south Delta dramatically during the key late winter and spring months and all other months.
- The X2 position is not shifted significantly with the Thru-Delta alternative even with the Delta outflow adjustments.
- The X2 position is not shifted significantly with the Dual alternative even with the Delta outflow adjustments.
- The flows at Antioch are increased dramatically with the Thru-Delta alternative.
- The flows at Antioch are increased dramatically with the Dual alternative.

Table I

Total CVP & SWP Exports - Existing Facilities
Delta Accord Water Quality Standards
Base Case

Period	Export Target (TAF)	Average Annual Exports (TAF)
1922-92	7,000	5,791
1928-34	7,000	4,512
1986-92	7,000	4,650

Table II

Total CVP & SWP Exports - Existing Facilities
Delta Accord Water Quality Standards +
Potential Worst Base Case

Period	Average Annual Exports (TAF)	Difference from the Base (TAF)
1922-92	5,549	-242
1928-34	4,056	-502
1986-92	4,408	-237

Table III

Total CVP & SWP Exports
Thru-Delta Water Transfer Facilities
Delta Accord Water Quality Standards +

Period	Average Annual Exports (TAF)	Difference from the Base (TAF)
1922-92	5,782	-9
1928-34	4,509	0
1986-92	4,711	65

Table IV

Total CVP & SWP Exports
Thru-Delta Water Transfer Facilities
Delta Accord Water Quality Standards +
with Adjusted Delta Outflow Requirements (relaxed X2)

Period	Average Annual Exports (TAF)	Difference from the Base (TAF)
1922-92	5,827	36
1928-34	4,652	160
1986-92	4,837	177

Table V

Total CVP & SWP Exports - 7,500 cfs
Dual Water Transfer Facility
Delta Accord Water Quality Standards +

Period	Average Annual Exports (TAF)	Difference from the Base (TAF)
1922-92	5,878	87
1928-34	4,628	95
1986-92	4,796	125

Table VI

Total CVP & SWP Exports - 7,500 cfs
Dual Water Transfer Facility
Delta Accord Water Quality Standards +
with Adjusted Delta Outflow Requirements

Period	Average Annual Exports (TAF)	Difference from the Base (TAF)
1922-92	5,929	139
1928-34	4,855	377
1986-92	4,944	279

Table A
No Delta Water Transfer Facilities
Operational Criteria[1]

	Parameter	Description	Water Year Type	Time Period	Value
Delta Outflow					
	Net Delta Outflow	Minimum monthly average (cfs)	All	Jan.	4,500[2]
			All	Feb-Jun	[3]
			W,AN	Jul	8,000
			BN		6,500
			D		5,000
			C		4,000
			W,AN,BN	Aug	4,000
			D		3,500
			C		3,000
			All	Sep	3,000
			W,AN,BN,D	Oct	4,000
			C		3,000
			W,AN,BN,D	Nov-Dec	4,500
			C		3,500
River Flows					
Sacramento River @ Rio Vista	Flow Rate	Minimum monthly average (cfs)	W,AN	Aug-Feb	4,500
				Mar&Jul	6,500
				Apr-Jun	9,000
			BN	Aug-Feb	4,000
				Mar&Jul	5,500
				Apr-Jun	7,000

[1] Maximum or most protective criteria. The Delta Accord standards would be the other end of the range of operational criteria for the no Delta water transfer facilities alternative.

[2] The objective is increased to 6,000 cfs if the best available estimate of the Eight River Index for December is greater than 800,000 AF.

[3] The minimum daily Delta outflow shall be 7,100 cfs for this period, calculated as a 3-day running average. This requirement is also met if either the daily average EC at the confluence of the Sacramento and San Joaquin rivers is less than or equal to 2.64 mmhos/cm (Collinsville station). The number of days when the maximum daily average electrical conductivity of 2.64 mmhos/cm must be maintained at the location shown in the attached State Board Table A.

	Parameter	Description	Water Year Type	Time Period	Value
			D	Aug-Feb	3,500
				Mar&Jul	4,500
				Apr-Jun	7,000
			C	Aug-Feb	3,000
				Mar&Jul	4,000
				Apr-Jun	6,000
Export Limits					
Exports @ Clifton Court & Tracy	Combined export rate	Maximum 3-day running average (cfs)	All	Apr 15-May 15 [4]	[5]
				May 16-May 31	[6]
				Jul-Oct	65% Delta inflow
				Nov-Apr 14	35% Delta inflow
Delta Cross Channel Gates Closure					
	Closure of gates	Close gates	All	Nov-Jun 15	

[4] This time period may be varied based on real-time monitoring and must coincide with the San Joaquin River pulse flow. The time period for this 31-day export limit will be determined by the CALFED operations group.

[5] Maximum export rate is 1,500 cfs or 50% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in critical years. Maximum export rate is 1,500 cfs or 40% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in dry years. Maximum export rate is 1,500 cfs or 30% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in below normal years. Maximum export rate is 1,500 cfs or 25% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in above normal years. Maximum export rate is 1,500 cfs or 20% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in wet years. These export restrictions does not supersede the export restriction of 35% of Delta inflow. The more restrictive of these two objectives applies from April 15 through May 15.

[6] The export percentage of Delta inflow should be ramped linearly from the 14 day average ratio that exists at the end of the San Joaquin River pulse flow to 35% on June 1.

Table B
Through Delta Water Transfer Facilities Operational Criteria

	Parameter	Description	Water Year Type	Time Period	Value
Delta Outflow					
	Net Delta Outflow	Minimum monthly average (cfs)	W,AN	Oct-Dec	4,500[1]
				Jan-Feb	6,000
				Mar	7,000
				Apr-Jun	12,000
				Jul	7,000
				Aug-Sep	4,500
			BN	Oct-Jan	4,500
				Feb	6,000
				Mar	7,000
				Apr-Jun	12,000
				Jul	5,500
				Aug-Sep	4,000
			D	Oct-Feb	3,000
				Mar	4,500
				Apr-Jun	7,000
				Jul	4,500
				Aug-Sep	3,000
			C	Oct-Feb	3,000
				Mar	4,500
				Apr-Jun	7,000
				Jul	4,500
				Aug-Sep	3,000

[1] A triggering methodology will be needed such as: assume the water year will be the same as the preceding year for the October through December period, January would be based on the December 8-River Index, and February would be based on the February 1 forecast. The year class would be reevaluated based on the first of the month forecast through April.

	Parameter	Description	Water Year Type	Time Period	Value
River Flows					
Sacramento River @ Rio Vista	Flow Rate	Minimum monthly Average (cfs)	W,AN	Aug-Feb	3,000
				Mar&Jul	5,000
				Apr-Jun	10,000
			BN	Aug-Feb	3,000
				Mar&Jul	4,000
				Apr-Jun	8,000
			D	Aug-Feb	3,000
				Mar&Jul	3,500
				Apr-Jun	6,000
			C	Jul-Mar	3,000
				Apr-Jun	4,500
Diversion Limit					
Diversion @ Hood	Combined export rate	Maximum 3-day running average (%[3])	All		[2]
				Mar	50
				Apr-May	35
				Jun	50

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[2] A real-time monitoring program foe eggs and larvae of all species of concern. This program shall be used to monitor the presence, density, and timing of striped bass eggs and larvae. This information shall be used to shut down the pumping plant for up to 20 days each year for the purpose of moving striped bass eggs and larvae past the Hood diversion.

[3] Maximum diversion rate is a percentage of the 3-day running average of Sacramento River flow at Freeport.

	Parameter	Description	Water Year Type	Time Period	Value
Export Limits					
Exports @ Clifton Court & Tracy	Combined export rate	Maximum 3-day running average (cfs)	All	Apr 15-May 15 [4]	[5]
				May 16-Jun 30	[6]
				Jul-Jan	65% Delta inflow
				Feb-Apr 14	35% Delta inflow
Delta Cross Channel Gates Closure					
	Closure of gates	Close gates	All	Oct-Sep	

[4] This time period may be varied based on real-time monitoring and must coincide with the San Joaquin River pulse flow. The time period for this 31-day export limit will be determined by the CALFED operations group.

[5] Maximum export rate is 1,500 cfs or 50% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in critical years. Maximum export rate is 1,500 cfs or 40% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in dry years. Maximum export rate is 1,500 cfs or 30% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in below normal years. Maximum export rate is 1,500 cfs or 25% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in above normal years. Maximum export rate is 1,500 cfs or 20% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in wet years. These export restrictions does not supersede the export restriction of 35% of Delta inflow. The more restrictive of these two objectives applies from April 15 through May 15.

[6] The export percentage of Delta inflow should be ramped linearly from the 14 day average ratio that exists at the end of the San Joaquin River pulse flow to 65% on July 1.

Table C
Dual Water Transfer Facilities
Operational Criteria[1]

	Parameter	Description	Water Year Type	Time Period	Value
Delta Outflow					
	Net Delta Outflow average (cfs)	Minimum monthly	W,AN	Oct-Dec	4,500[2]
				Jan-Feb	6,000
				Mar	7,000
				Apr-Jun	12,000
				Jul	7,000
				Aug-Sep	4,500
			BN	Oct-Jan	4,500
				Feb	6,000
				Mar	7,000
				Apr-Jun	12,000
				Jul	5,500
				Aug-Sep	4,000
			D	Oct-Feb	3,000
				Mar	4,500
				Apr-Jun	7,000
				Jul	4,500
				Aug-Sep	3,000
			C	Oct-Feb	3,000
				Mar	4,500
				Apr-Jun	7,000
				Jul	4,500
				Aug-Sep	3,000

[1] Urban/Ag upper end of the range Bay-Delta ops. criteria for a dual water transfer facility.

[2] A triggering methodology will be needed such as: assume the water year will be the same as the preceding year for the October through December period, January would be based on the December 8-River Index, and February would be based on the February 1 forecast. The year class would be reevaluated based on the first of the month forecast through April.

Parameter	Description Type	Water Year Period	Time	Value	
River Flows					
Sacramento River @ Rio Vista	Flow Rate monthly average (cfs)	Minimum	W,AN	Aug-Feb	3,000
				Mar&Jul	5,000
				Apr-Jun	10,000
			BN	Aug-Feb	3,000
				Mar&Jul	4,000
				Apr-Jun	8,000
			D	Aug-Feb	3,000
				Mar&Jul	3,500
				Apr-Jun	6,000
			C	Jul-Mar	3,000
				Apr-Jun	4,500
Export Limits					
Export @ Hood	Combined export rate	Maximum 3-day running average (%[3])	W,AN,BN	Mar	35
				Apr-Jun	15
			D,C	Mar	35
				Apr-May	15
				Jun	35

[3] Maximum export rate is a percentage of the 3-day running average of Sacramento River flow at Freeport.

	Parameter	Description	Water Year Type	Time Period	Value
Exports @ Clifton Court & Tracy	Combined export rate	Maximum 3-day running average (cfs)	All	Apr 15-May 15 [4]	[5]
				May 16-Jun 30	[6]
				Jul-Oct	65% Delta inflow[7]
				Nov-Apr 14	35% Delta inflow

Delta Cross Channel Gates Closure

	Parameter	Description	Water Year Type	Time Period	Value
	Closure of gates	Close gates	All	Nov-Jun 15	
			Jun 15-Oct[8]		

[4] This time period may be varied based on real-time monitoring and must coincide with the San Joaquin River pulse flow. The time period for this 31-day export limit will be determined by the CALFED operations group.

[5] Maximum export rate is 1,500 cfs or 50% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in critical years. Maximum export rate is 1,500 cfs or 40% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in dry years. Maximum export rate is 1,500 cfs or 30% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in below normal years. Maximum export rate is 1,500 cfs or 25% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in above normal years. Maximum export rate is 1,500 cfs or 20% of 3-day running average of San Joaquin River flow at Vernalis, whichever is greater in wet years. These export restrictions does not supersede the export restriction of 35% of Delta inflow. The more restrictive of these two objectives applies from April 15 through May 15.

[6] The export percentage of Delta inflow should be ramped linearly from the 14 day average ratio that exists at the end of the San Joaquin River pulse flow to 65% on July 1.

[7] The NDOI calculation should be done using the Sacramento River at Freeport minus diversions at Hood mean daily flow for the previous day when the projects are exporting at Hood and at Freeport when the projects are not exporting at Hood.

[8] Gates can be opened if required to meet the interior Delta agriculture and urban water quality objectives. The decision to open the gates should be made by the SWRCB Executive Director after consultation with the CALFED operations group.

Figure 1:

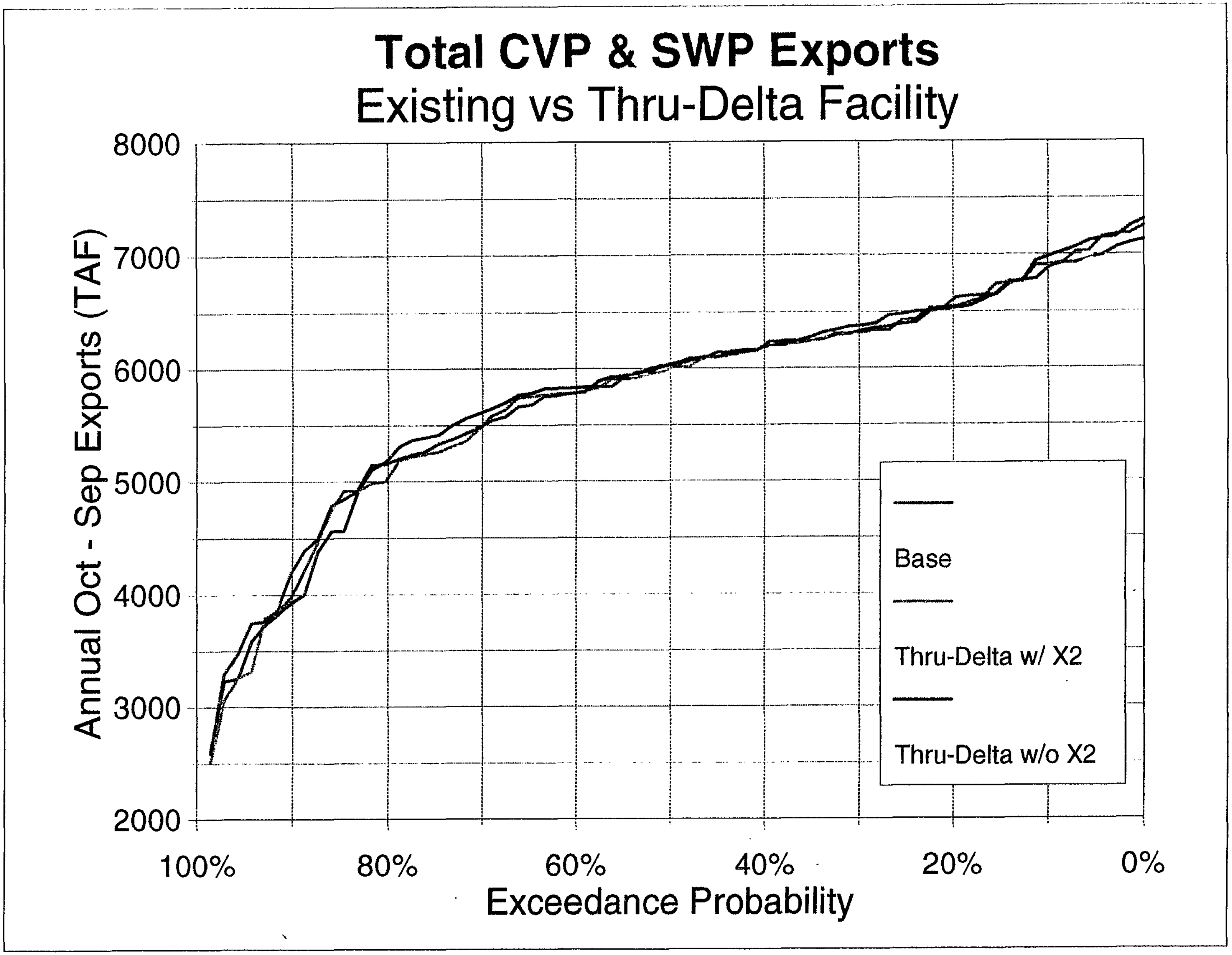

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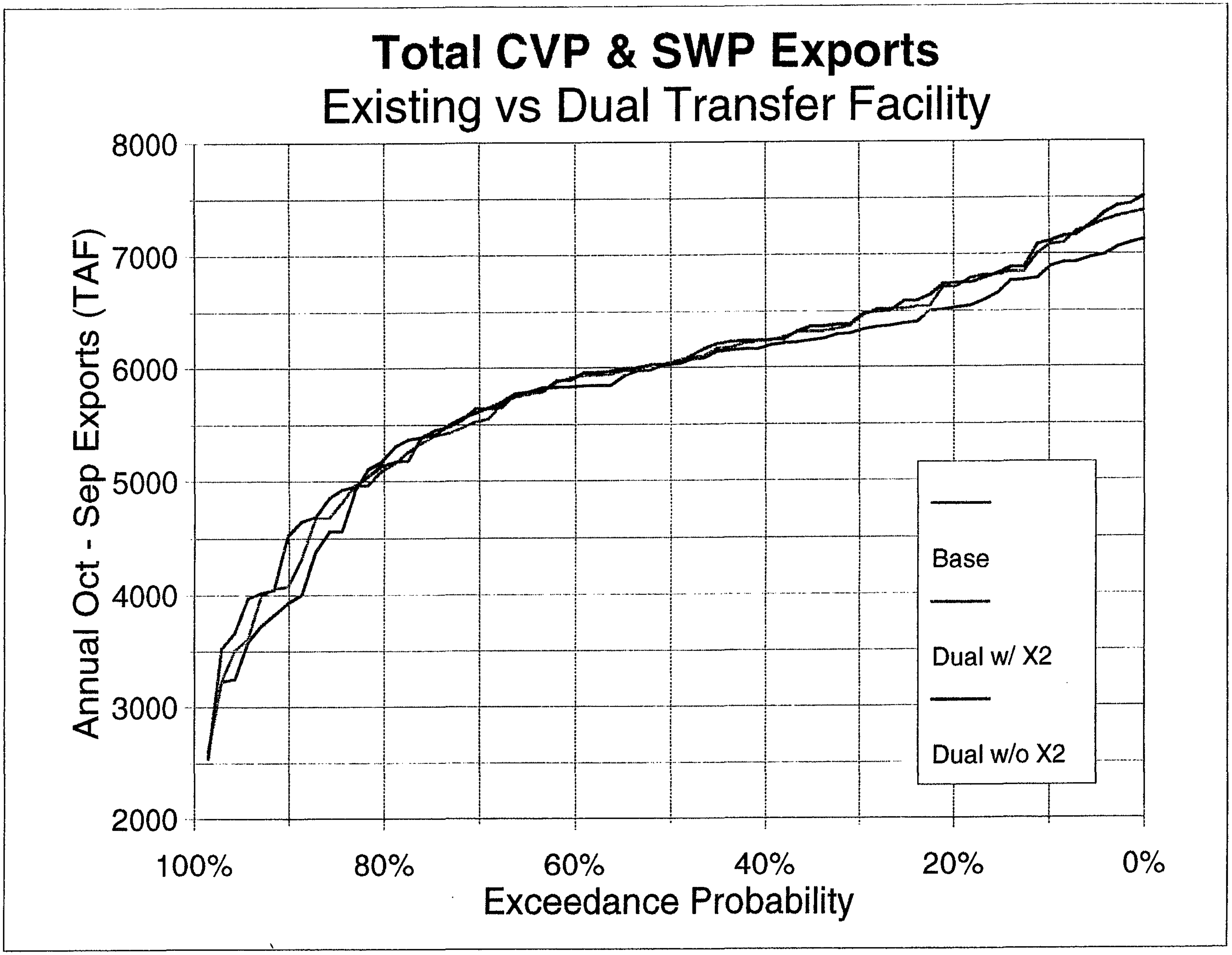
Figure 2:



Total CVP & SWP Exports
Existing vs Dual Transfer Facility
Annual Oct - Sep Exports (TAF)
8000
7000
6000
5000
4000
3000
2000
100%
80%
60%
40%
20%
0%
Exceedance Probability
Base
Dual w/ X2
Dual w/o X2

Figure 3:

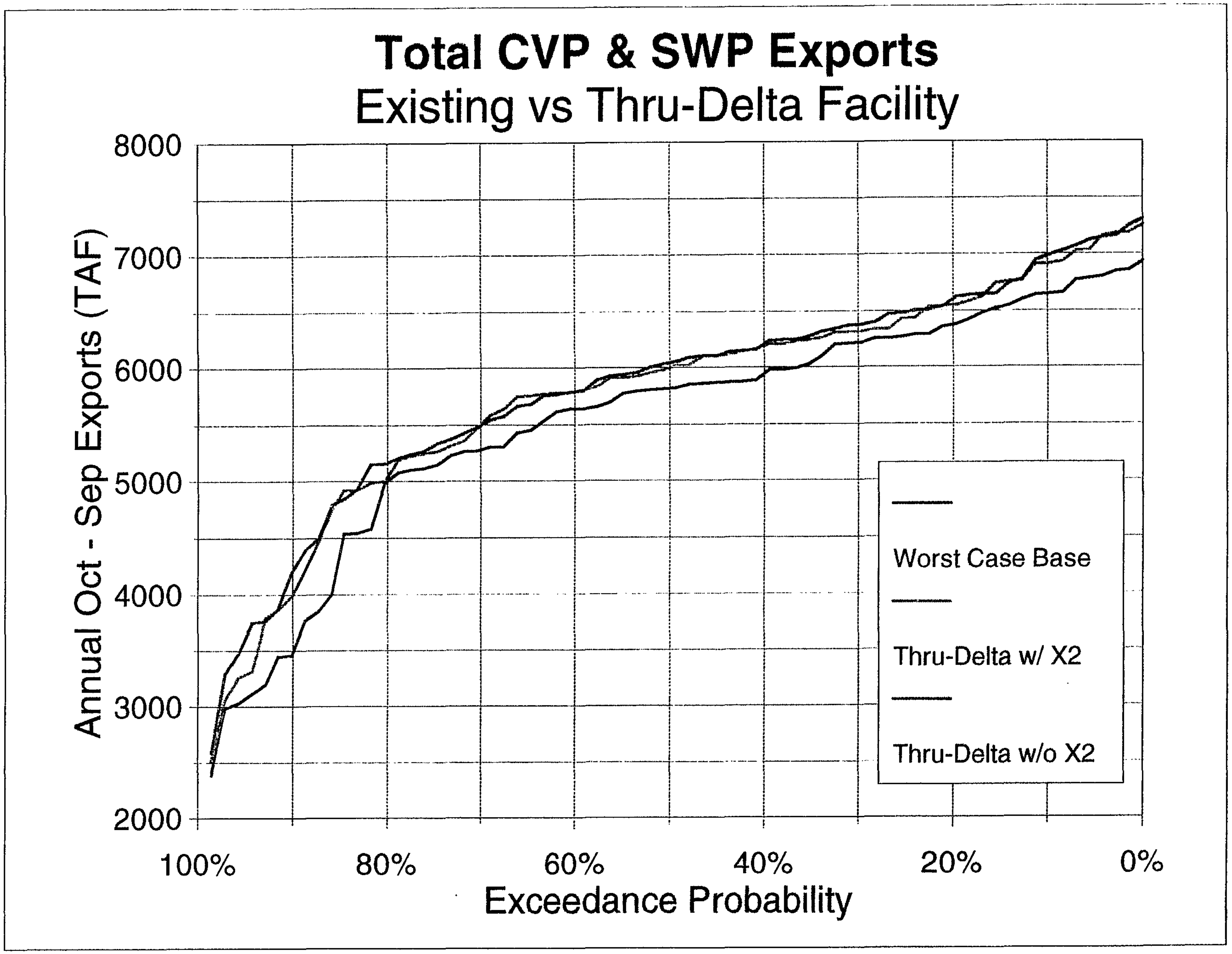


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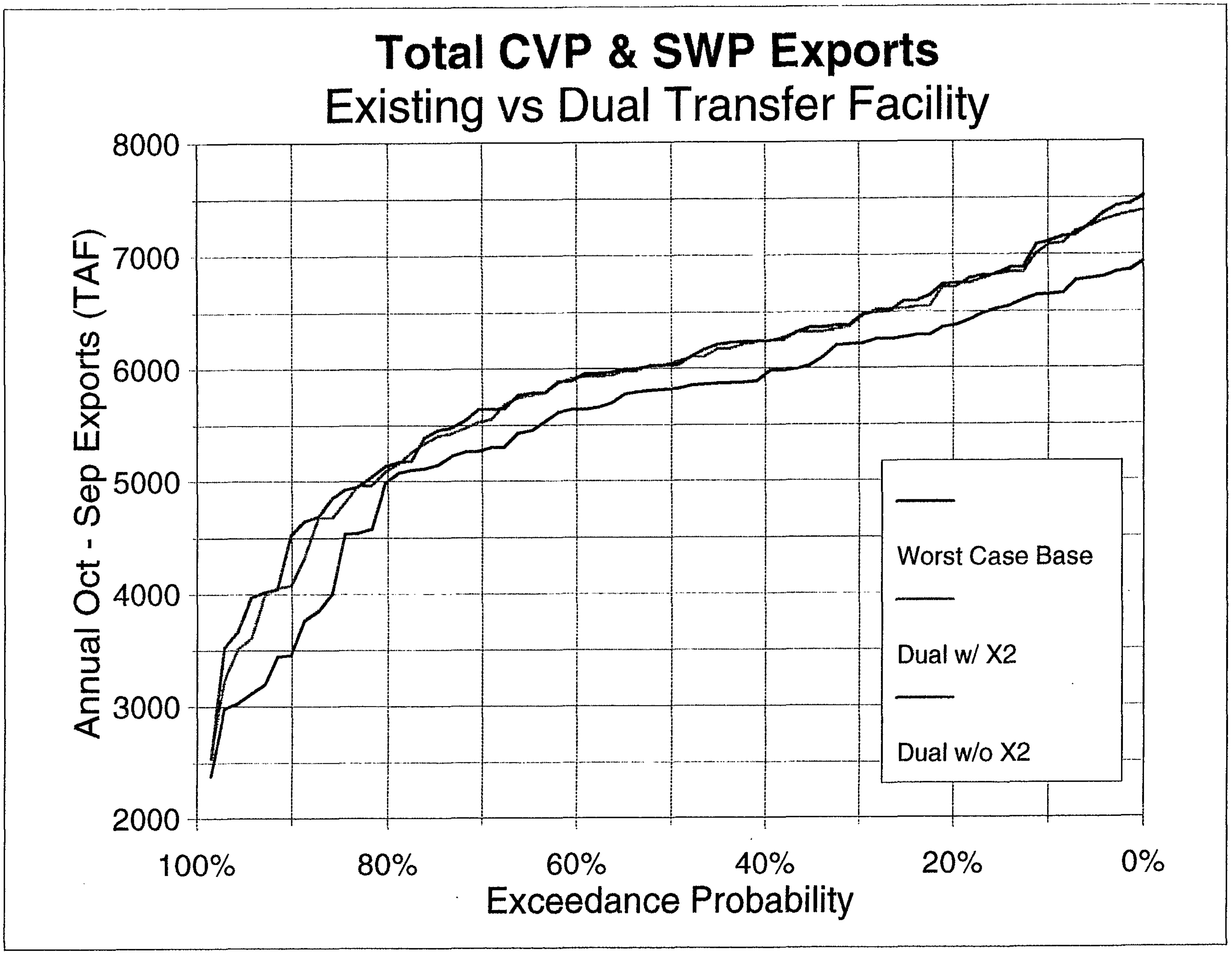
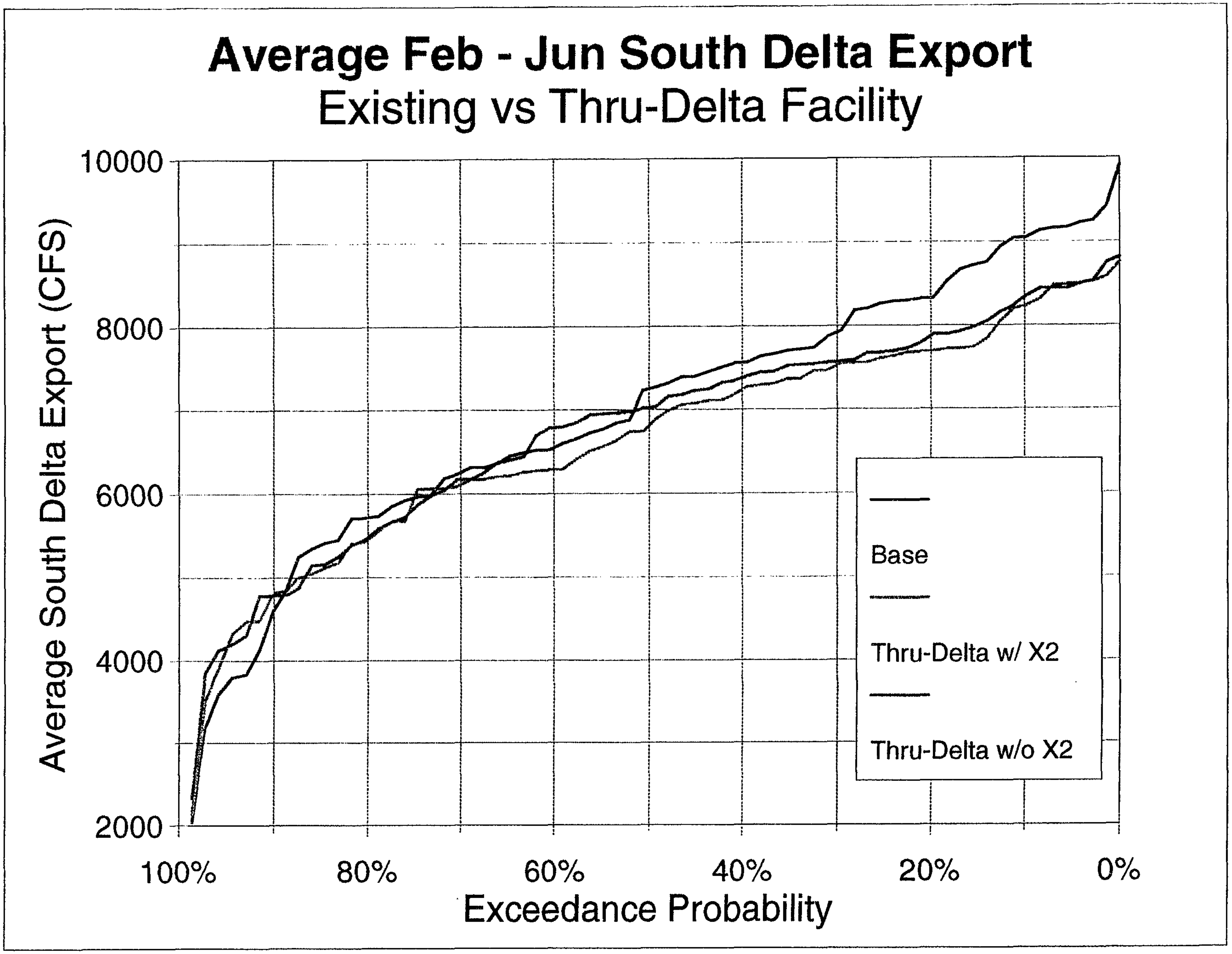
Figure 4:



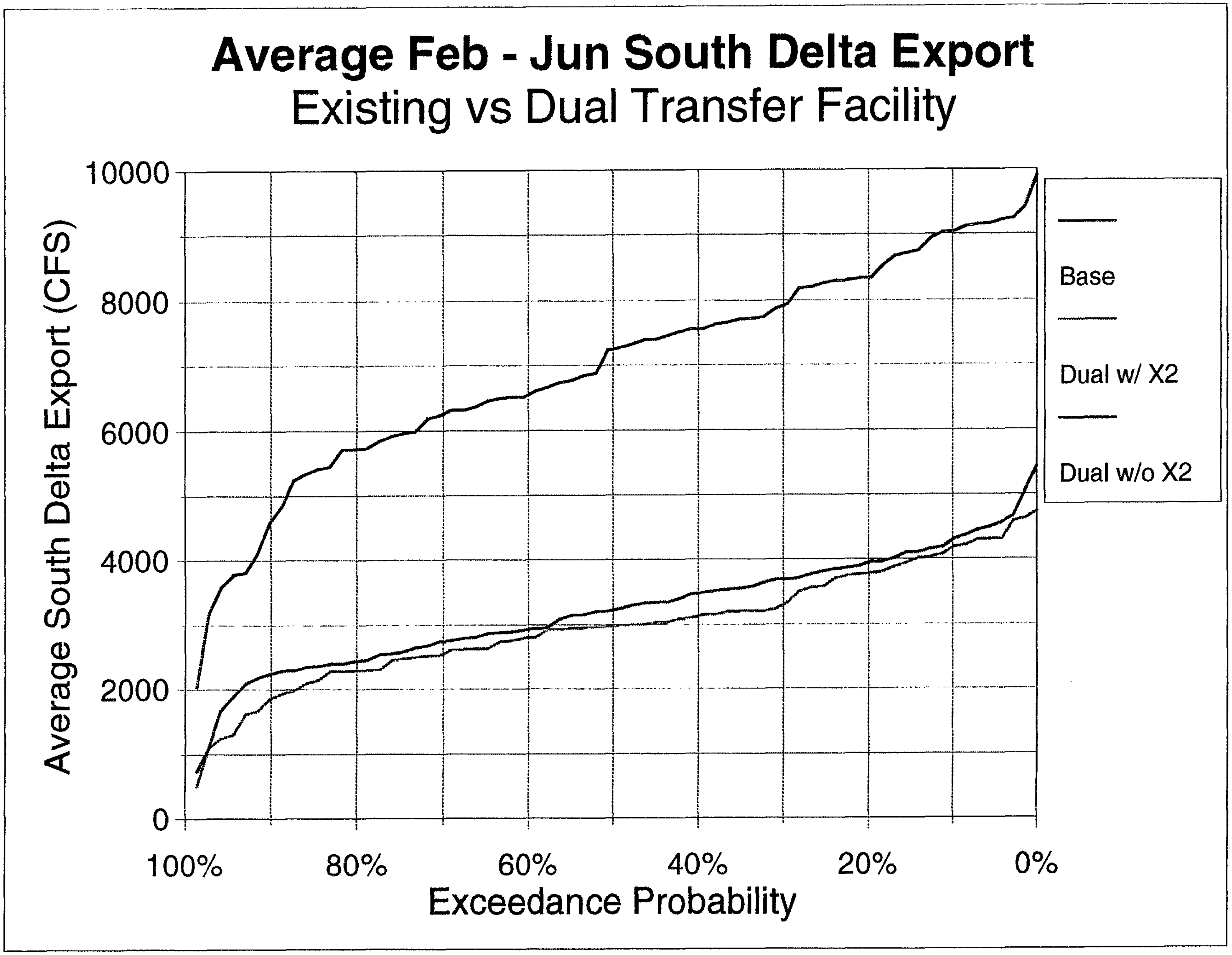
Total CVP & SWP Exports
Existing vs Dual Transfer Facility
8000
7000
6000
5000
4000
3000
2000
Annual Oct - Sep Exports (TAF)
100%
80%
60%
40%
20%
0%
Exceedance Probability
Worst Case Base
Dual w/ X2
Dual w/o X2

Figure 5:



D-007618

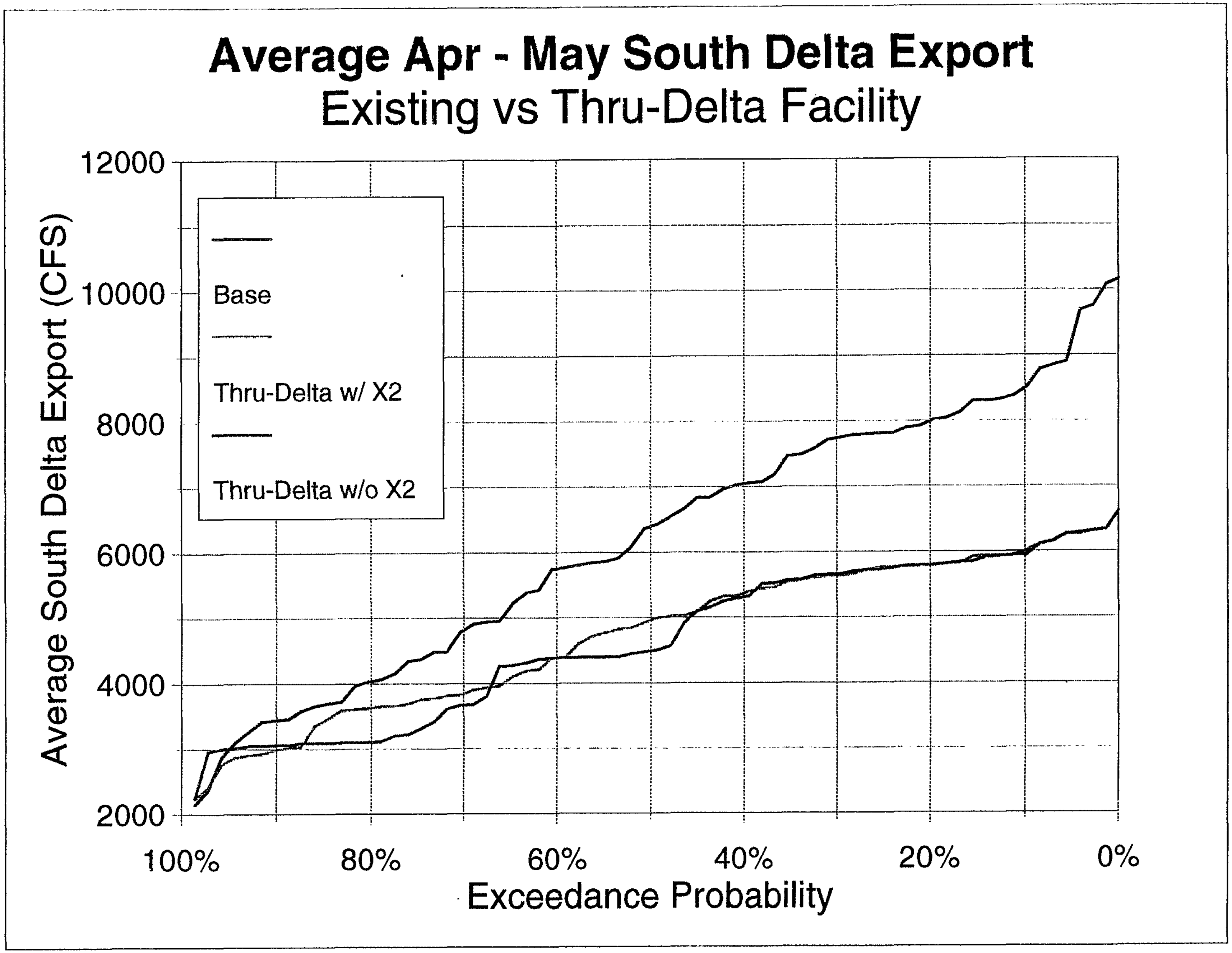
Figure 6:



D-007619

D—007619

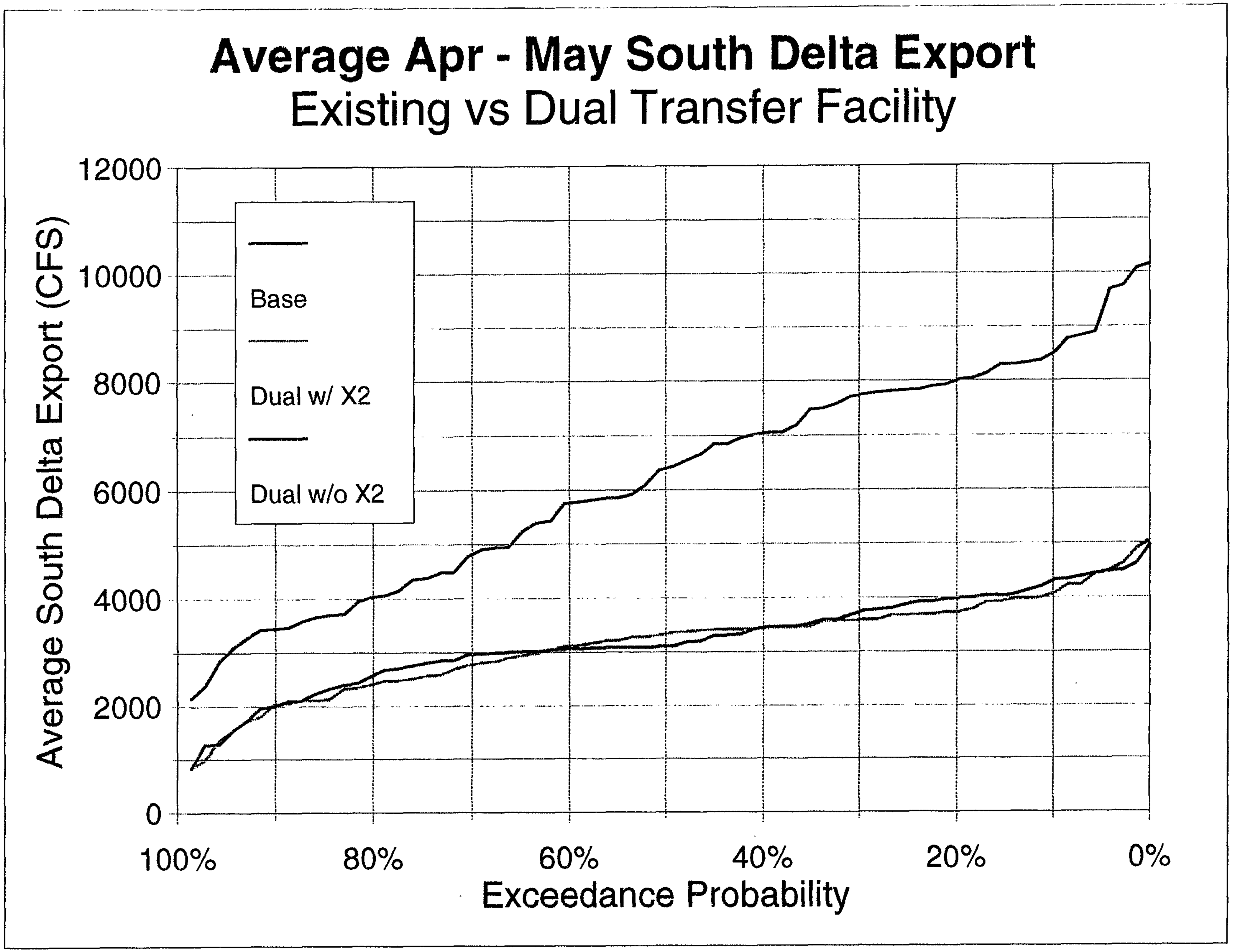
Figure 7:



D-007620

D-007620

Figure 8:



Average Apr - May South Delta Export
Existing vs Dual Transfer Facility
Average South Delta Export (CFS)
12000
10000
8000
6000
4000
2000
0
Base
Dual w/ X2
Dual w/o X2
100%
80%
60%
40%
20%
0%
Exceedance Probability

Figure 9:

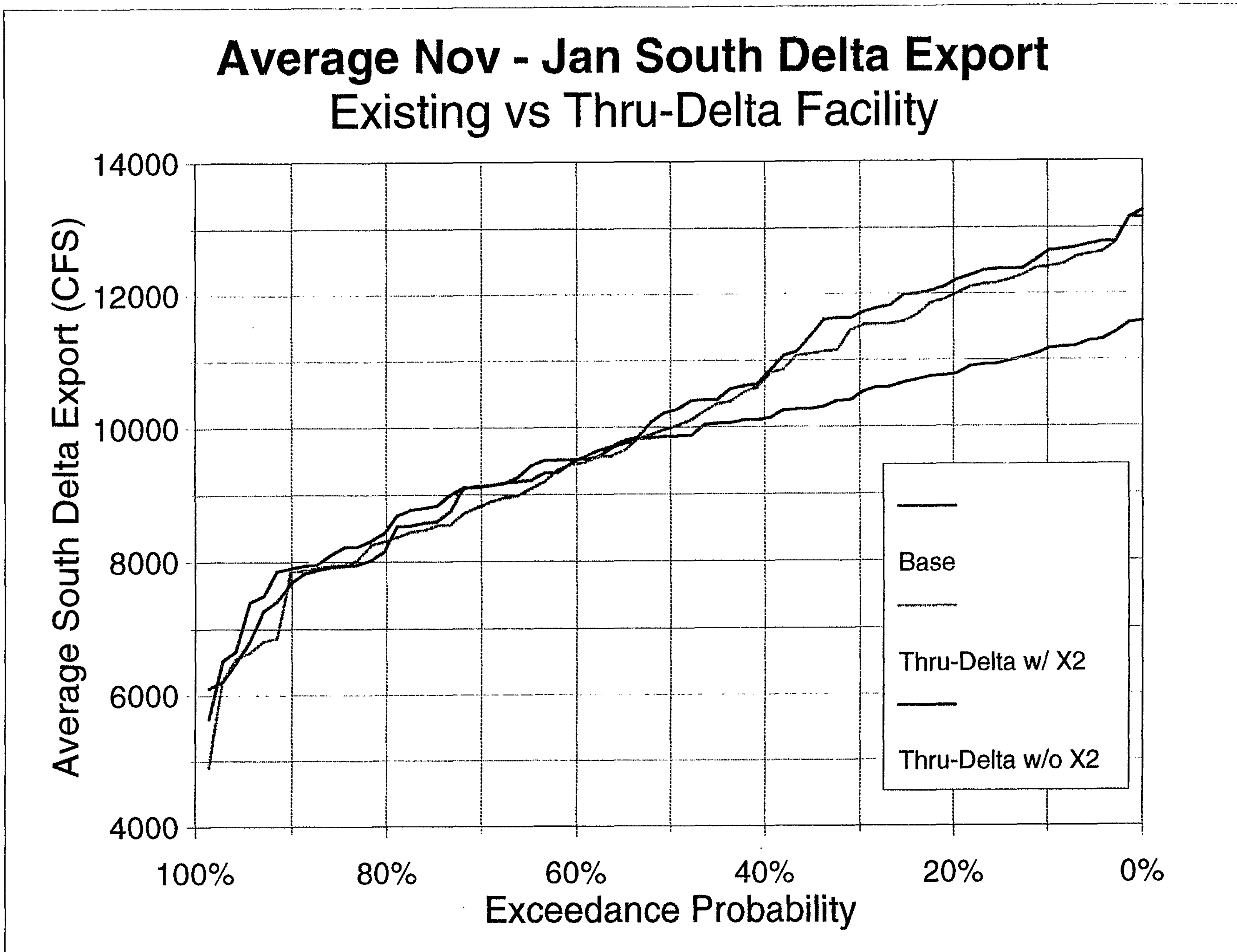
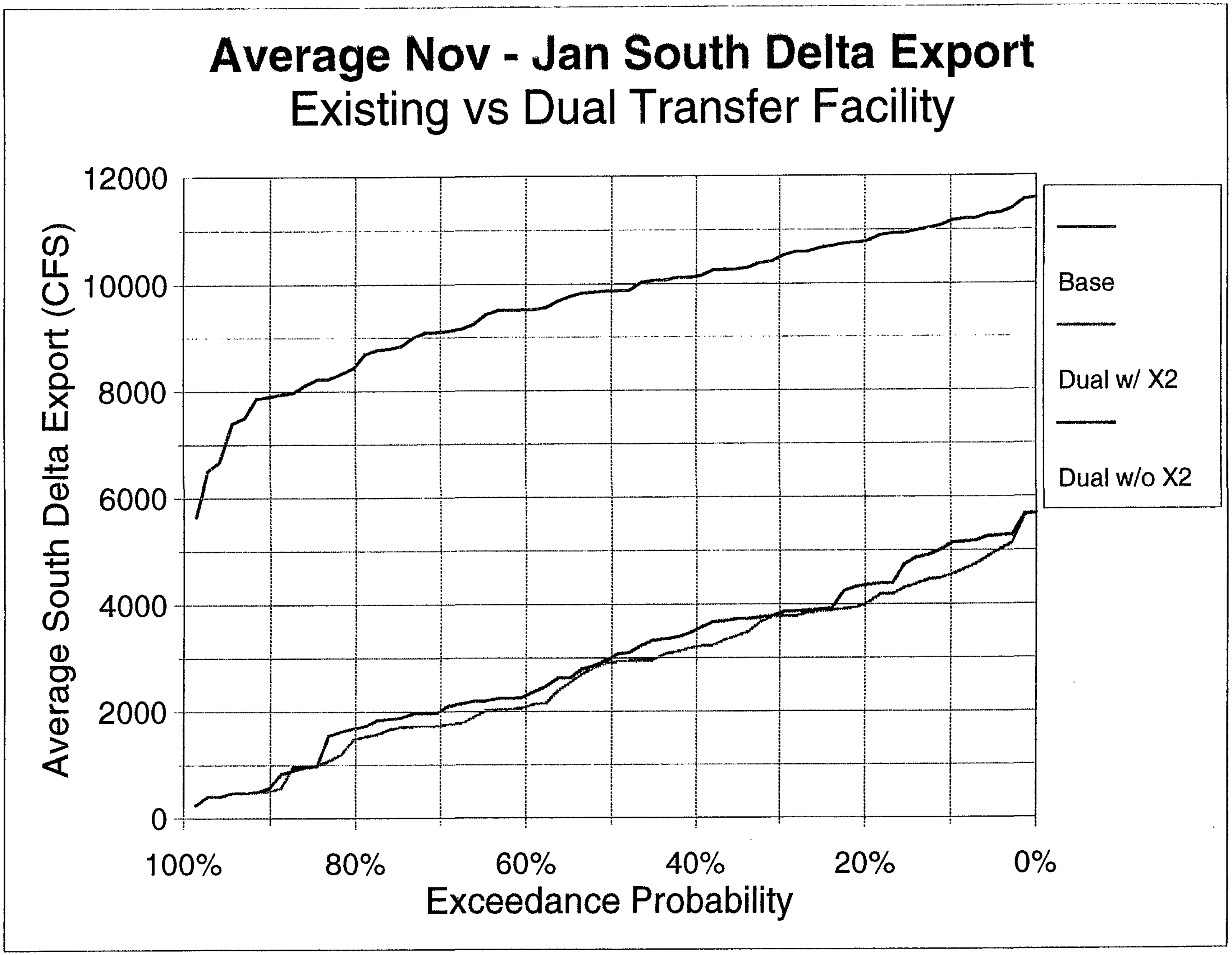
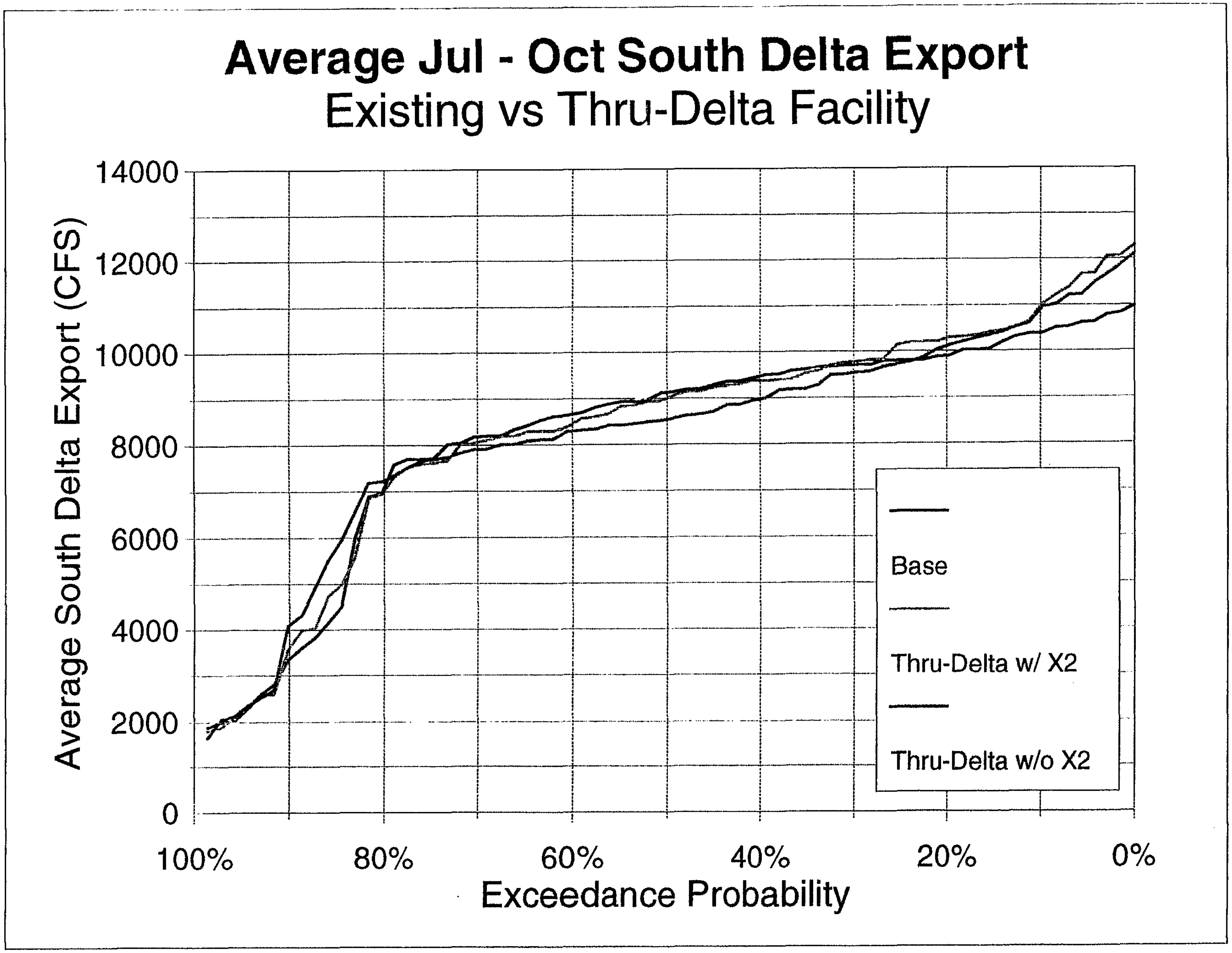

Average Nov - Jan South Delta Export
Existing vs Thru-Delta Facility
Average South Delta Export (CFS)
14000
12000
10000
8000
6000
4000
100%
80%
60%
40%
20%
0%
Exceedance Probability
Base
Thru-Delta w/ X2
Thru-Delta w/o X2

Figure 10:



Average Nov - Jan South Delta Export
Existing vs Dual Transfer Facility
Average South Delta Export (CFS)
12000
10000
8000
6000
4000
2000
0
100%
80%
60%
40%
20%
0%
Exceedance Probability
Base
Dual w/ X2
Dual w/o X2

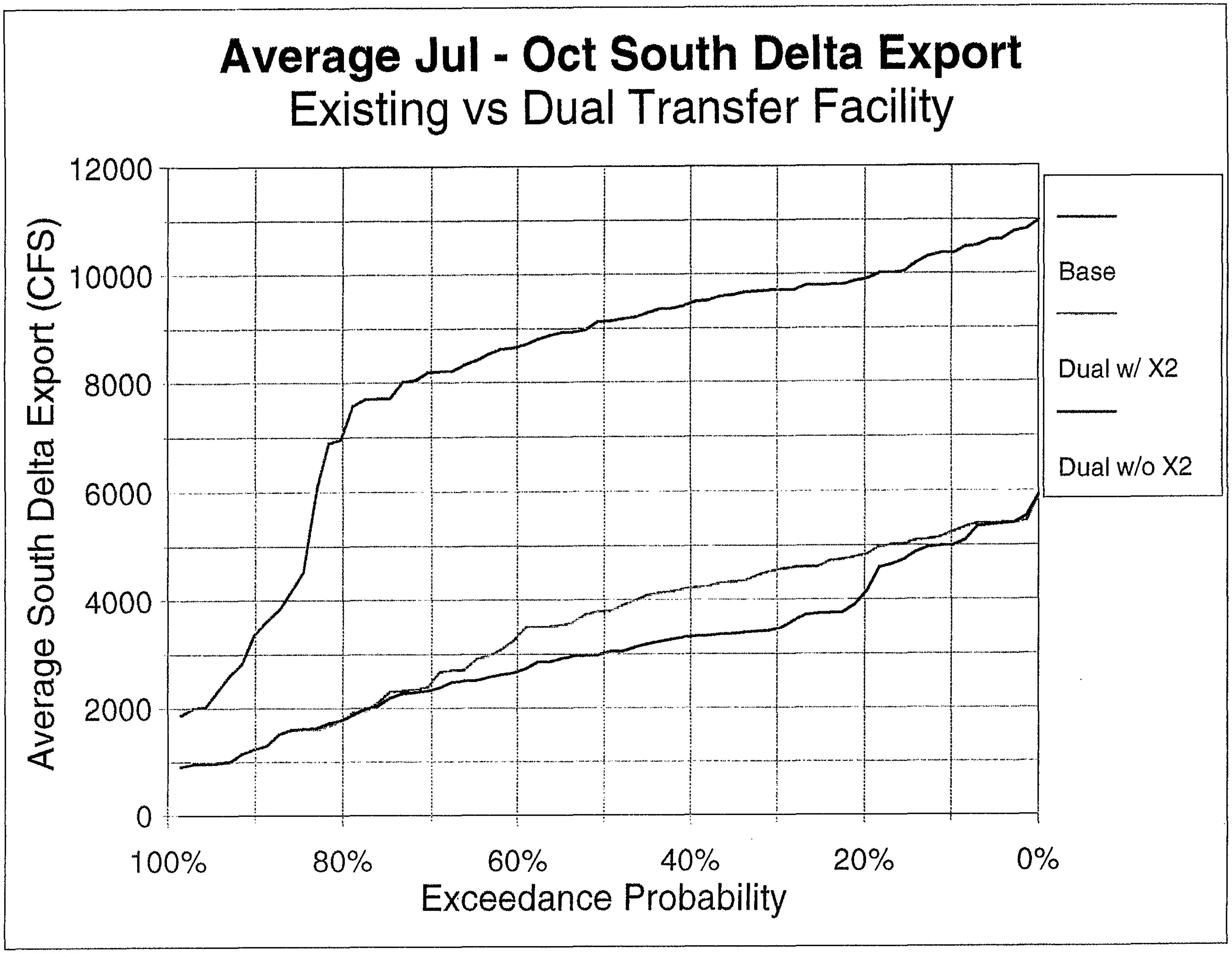
Figure 11:



D-007624

D-007624

Figure 12:



D-007625

D—007625

Figure 13:

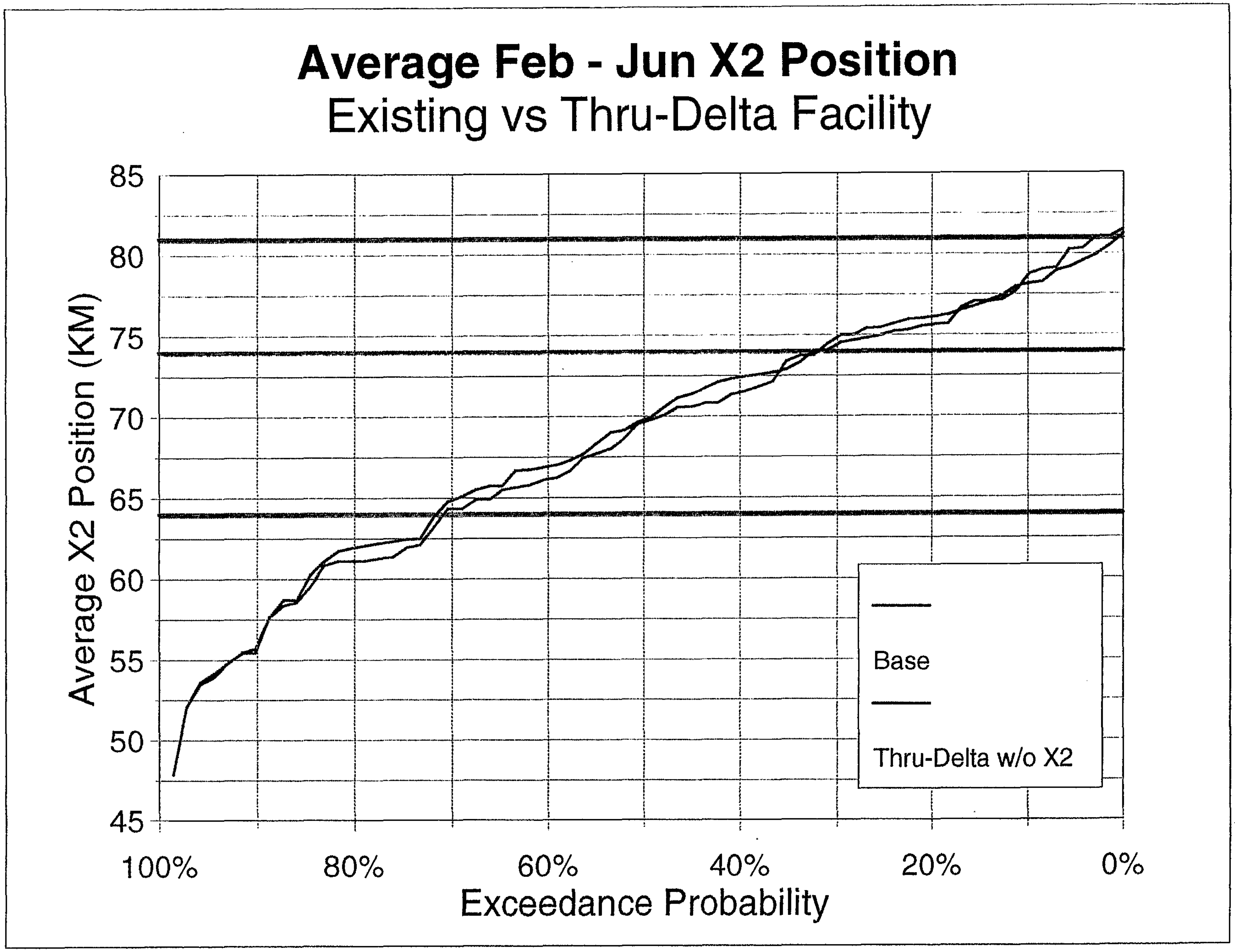
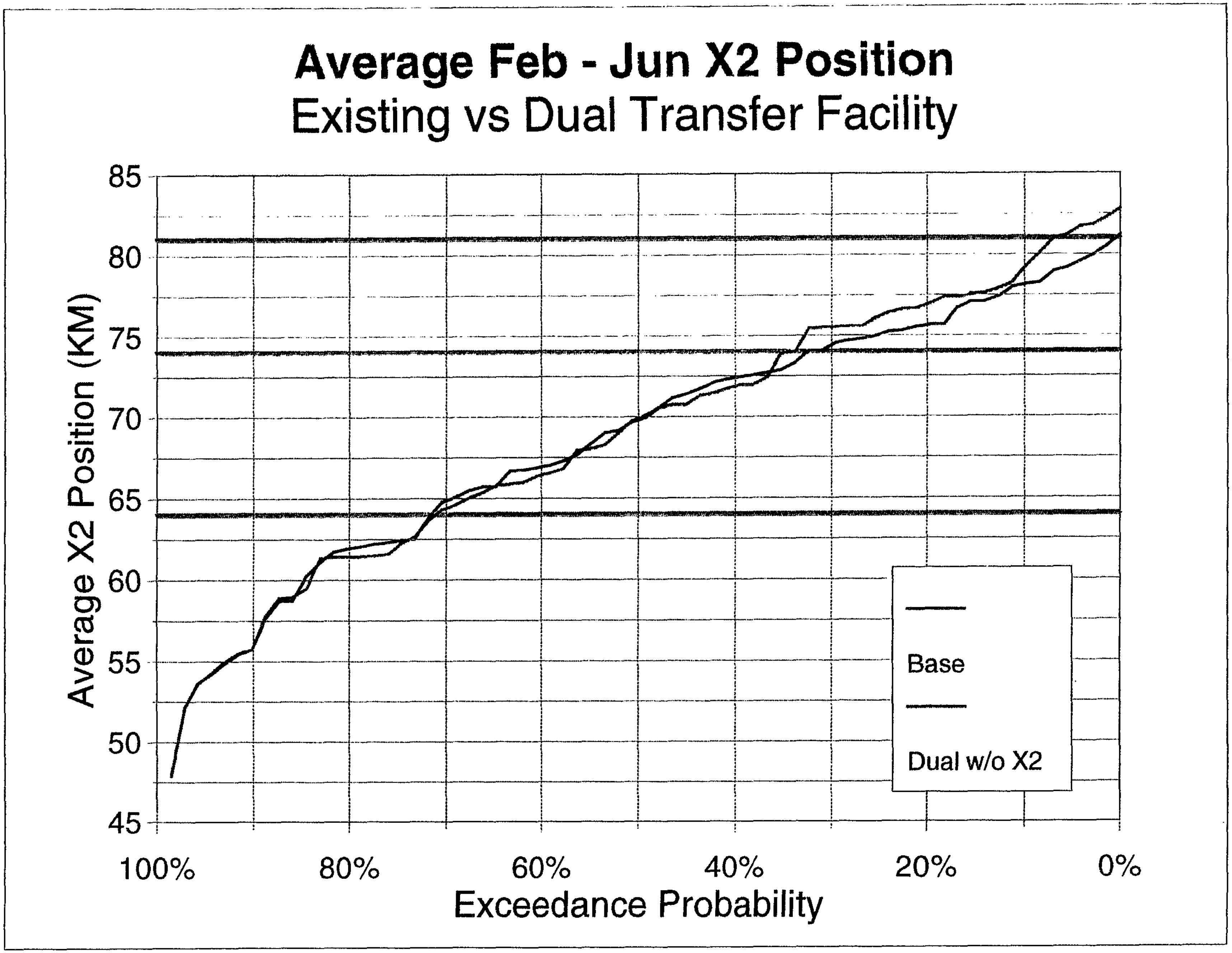

Average Feb - Jun X2 Position
Existing vs Thru-Delta Facility
Average X2 Position (KM)
85
80
75
70
65
60
55
50
45
100%
80%
60%
40%
20%
0%
Exceedance Probability
Base
Thru-Delta w/o X2

Figure 14:



Average Feb - Jun X2 Position
Existing vs Dual Transfer Facility
Average X2 Position (KM)
85
80
75
70
65
60
55
50
45
100%
80%
60%
40%
20%
0%
Exceedance Probability
Base
Dual w/o X2

Figure 15:

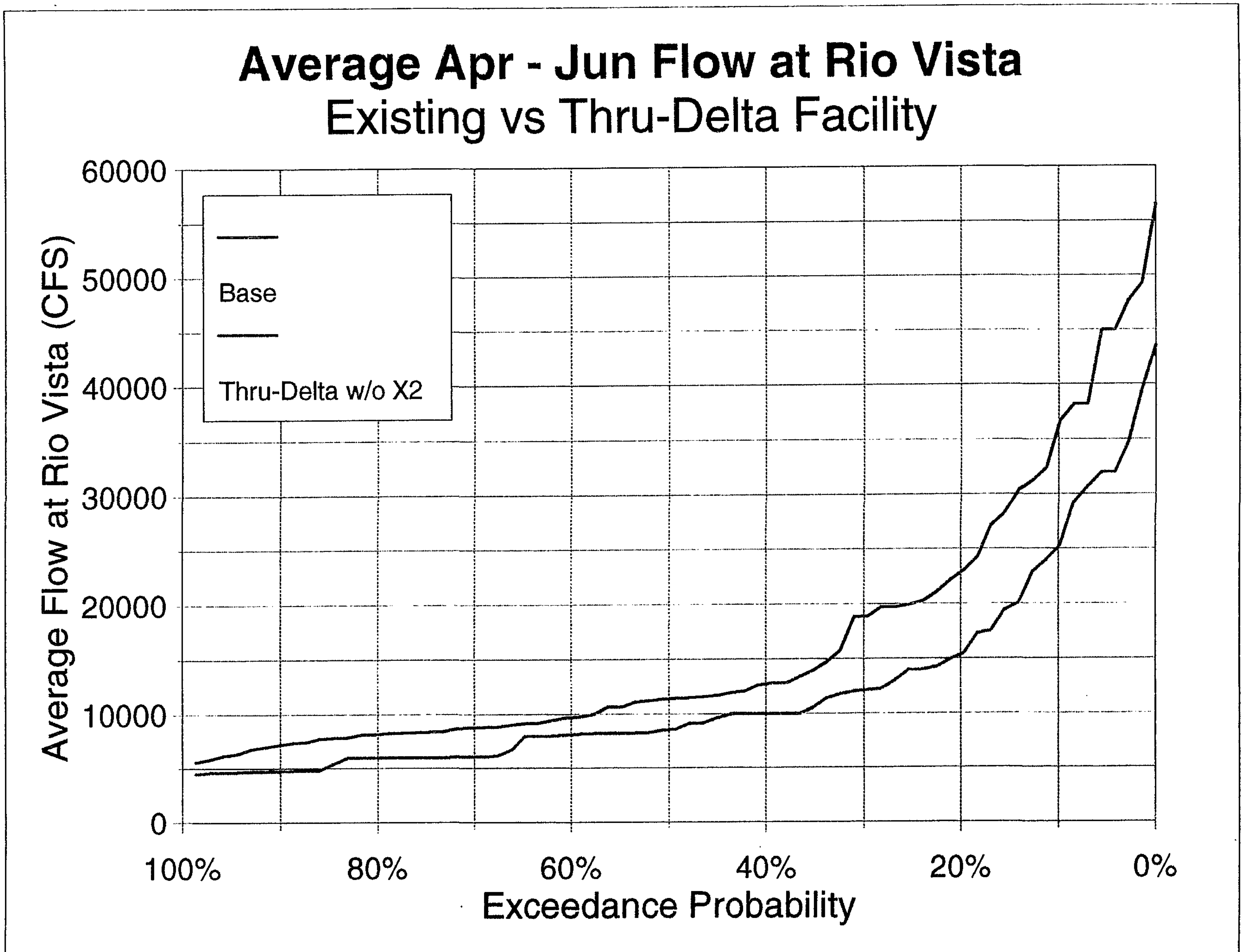
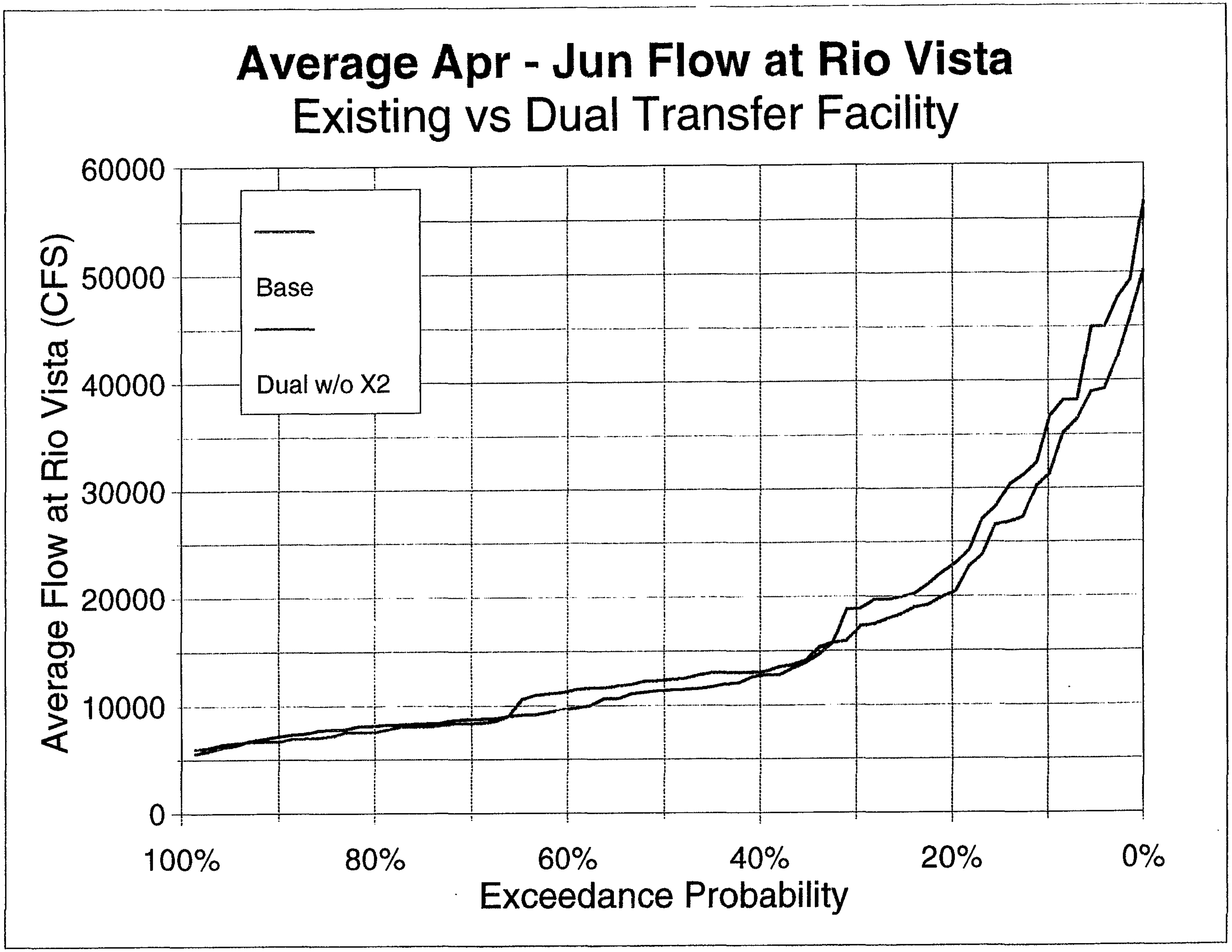

Average Apr - Jun Flow at Rio Vista
Existing vs Thru-Delta Facility
Average Flow at Rio Vista (CFS)
60000
50000
40000
30000
20000
10000
0
Base
Thru-Delta w/o X2
100%
80%
60%
40%
20%
0%
Exceedance Probability

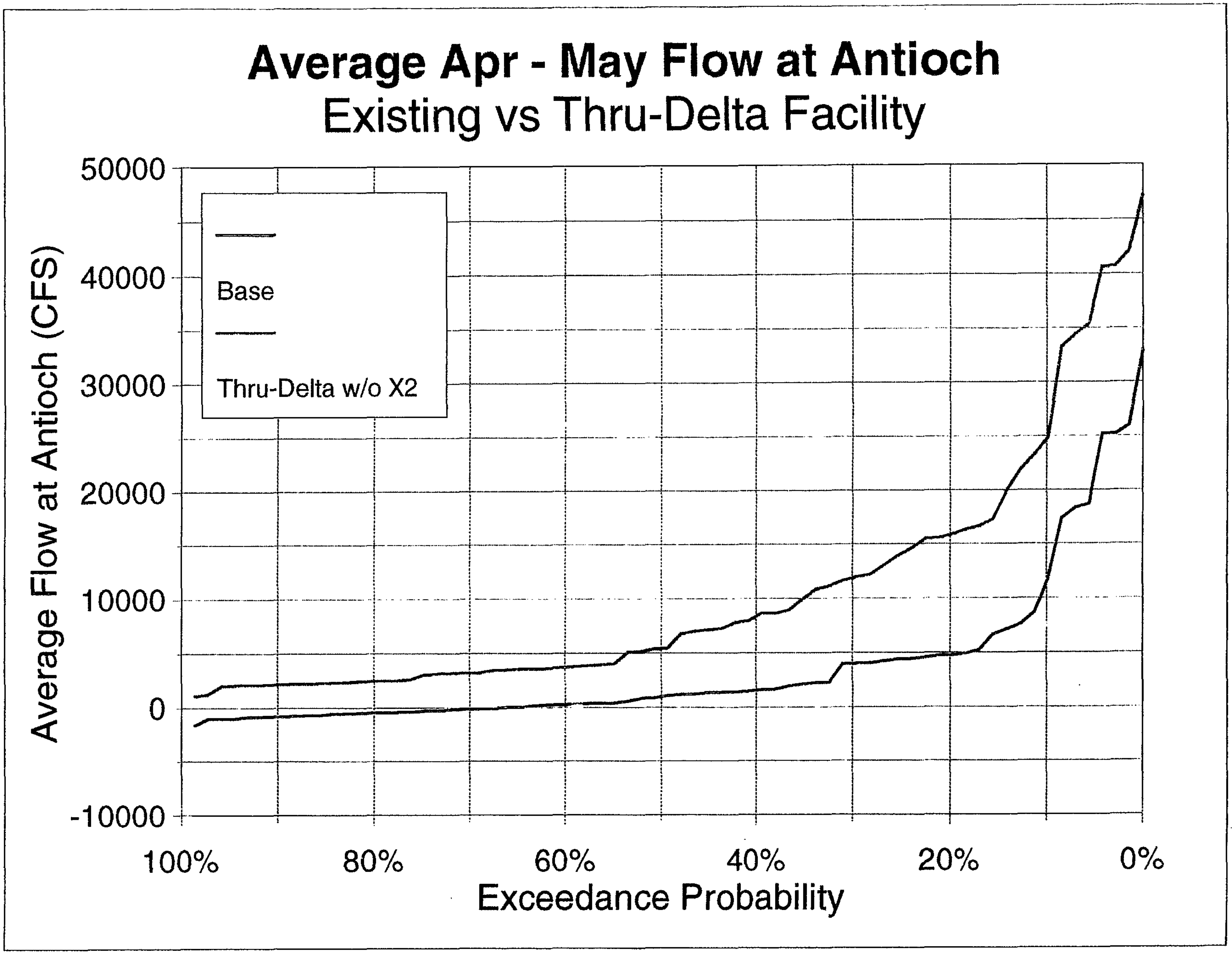
Figure 16:



D-007629

D-007629

Figure 17:



D-007630

D—007630

Figure 18:

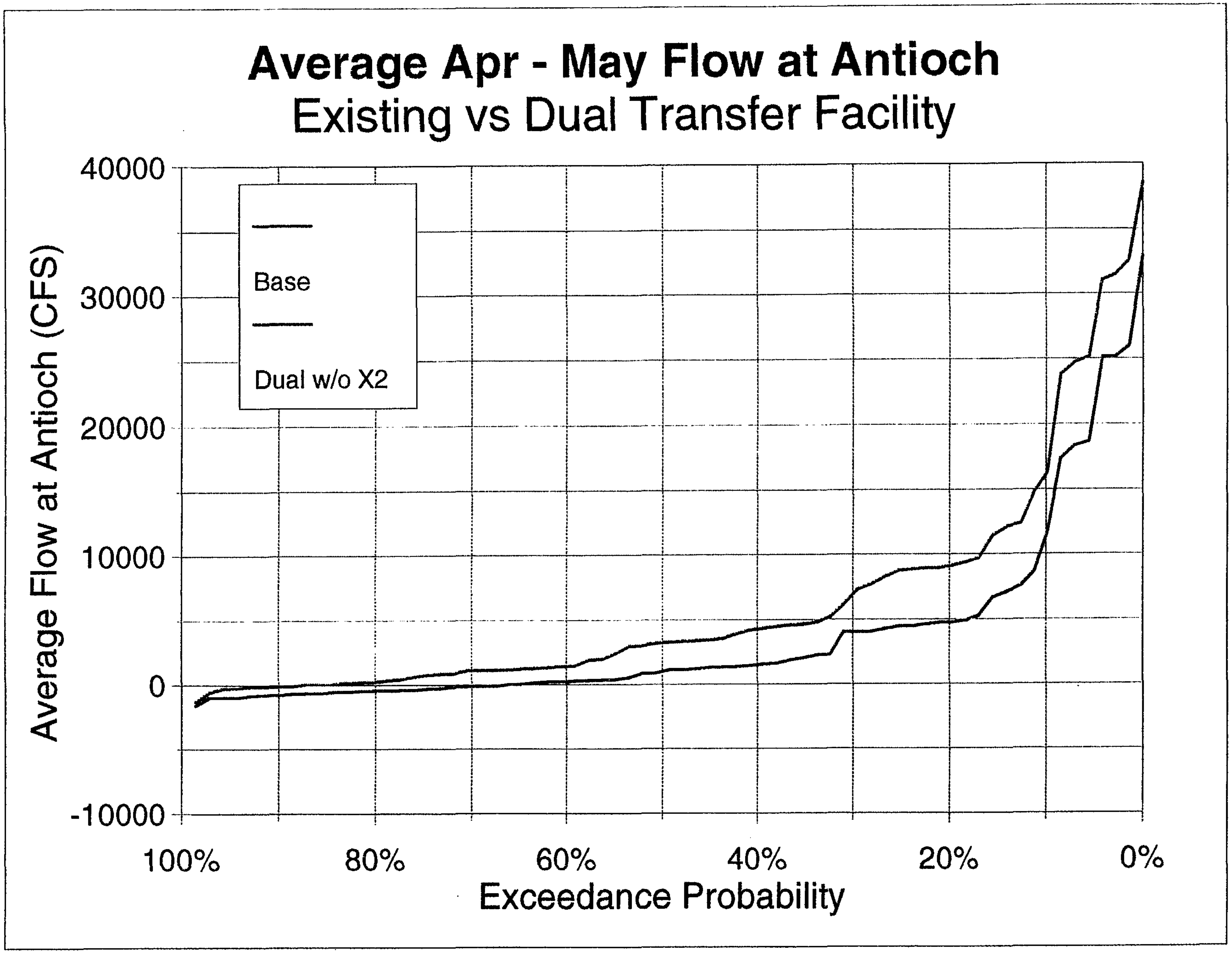

Average Apr - May Flow at Antioch
Existing vs Dual Transfer Facility
Average Flow at Antioch (CFS)
40000
30000
20000
10000
0
-10000
Base
Dual w/o X2
100%
80%
60%
40%
20%
0%
Exceedance Probability

Figure 19:

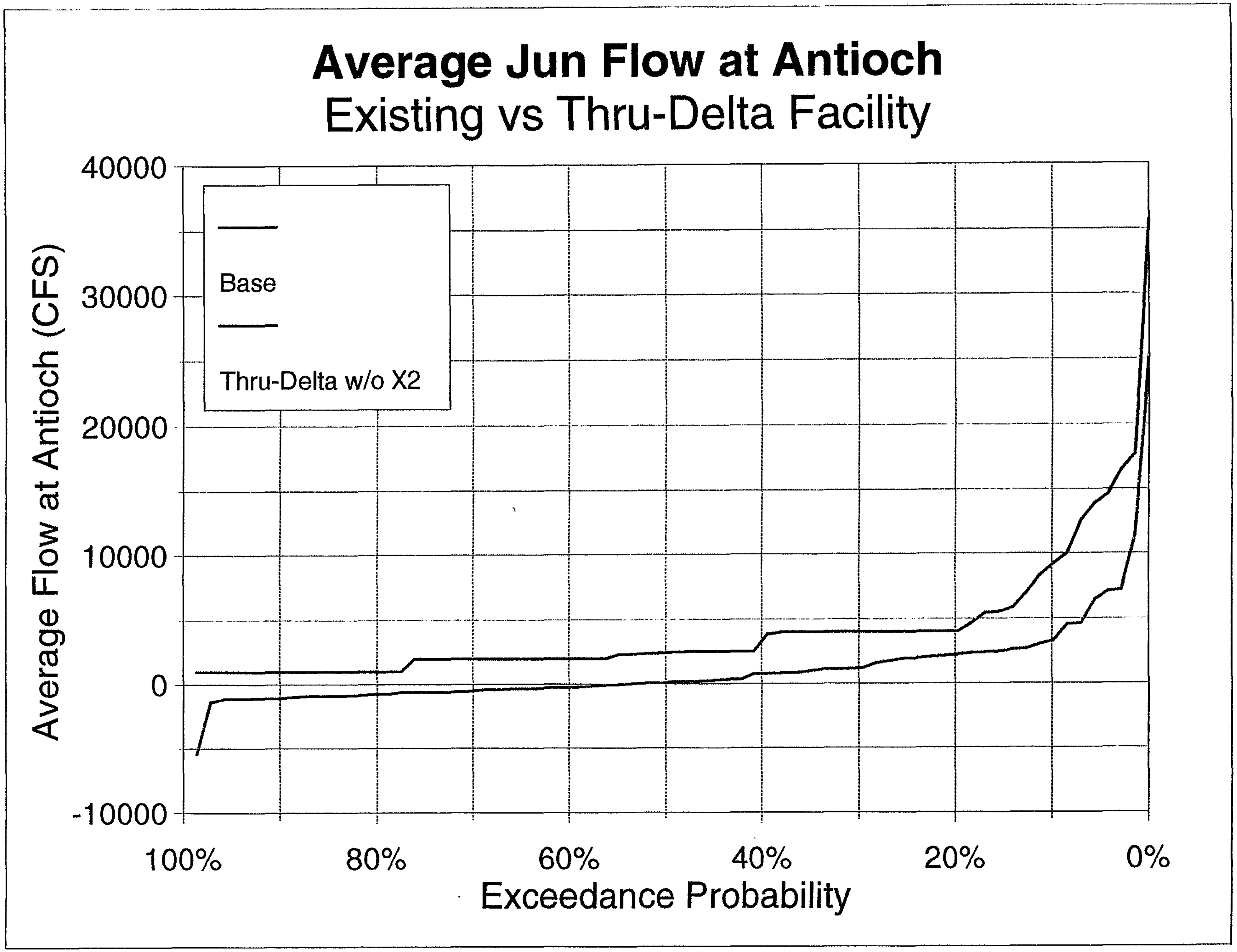
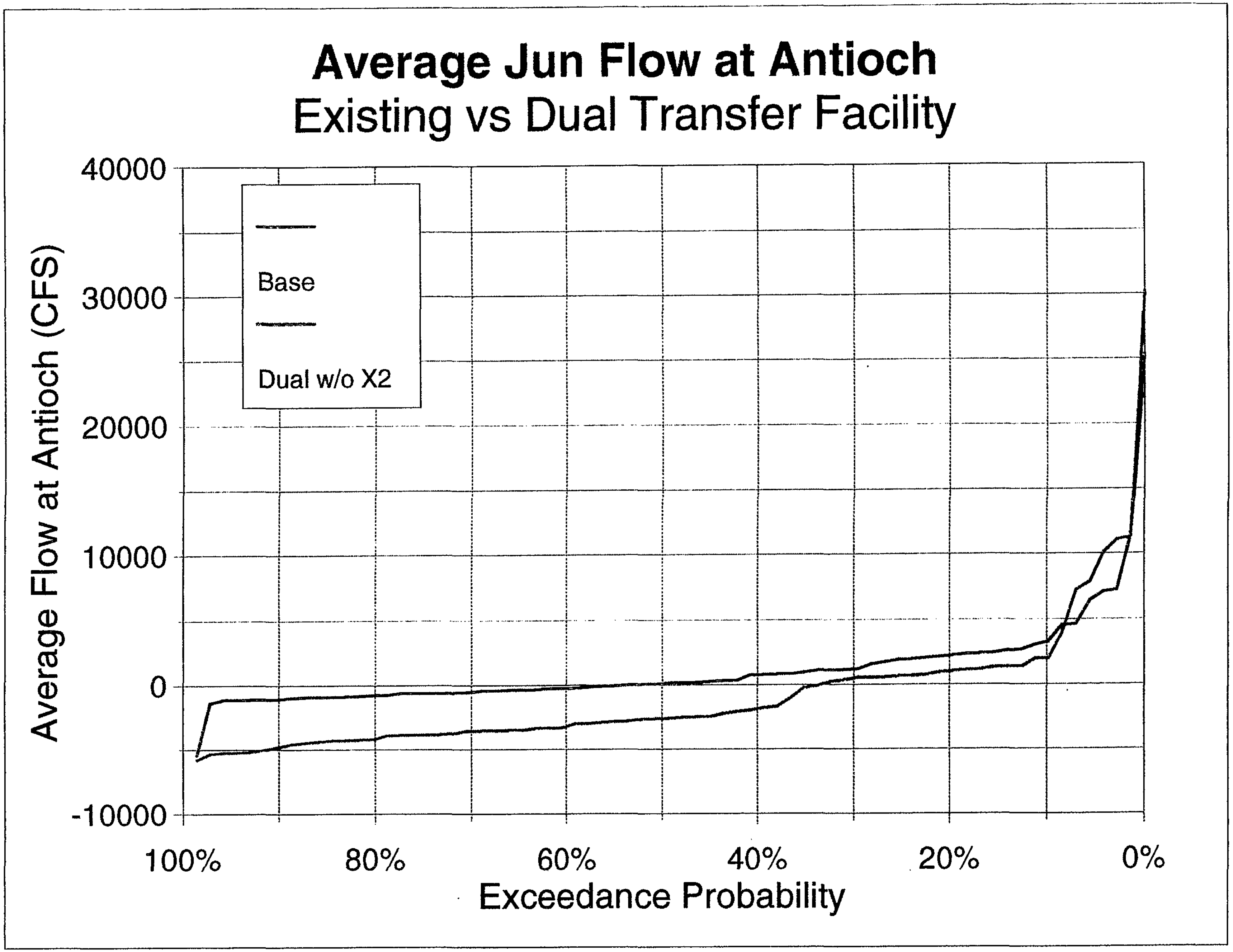

Average Jun Flow at Antioch
Existing vs Thru-Delta Facility
Average Flow at Antioch (CFS)
40000
30000
20000
10000
0
-10000
Base
Thru-Delta w/o X2
100%
80%
60%
40%
20%
0%
Exceedance Probability

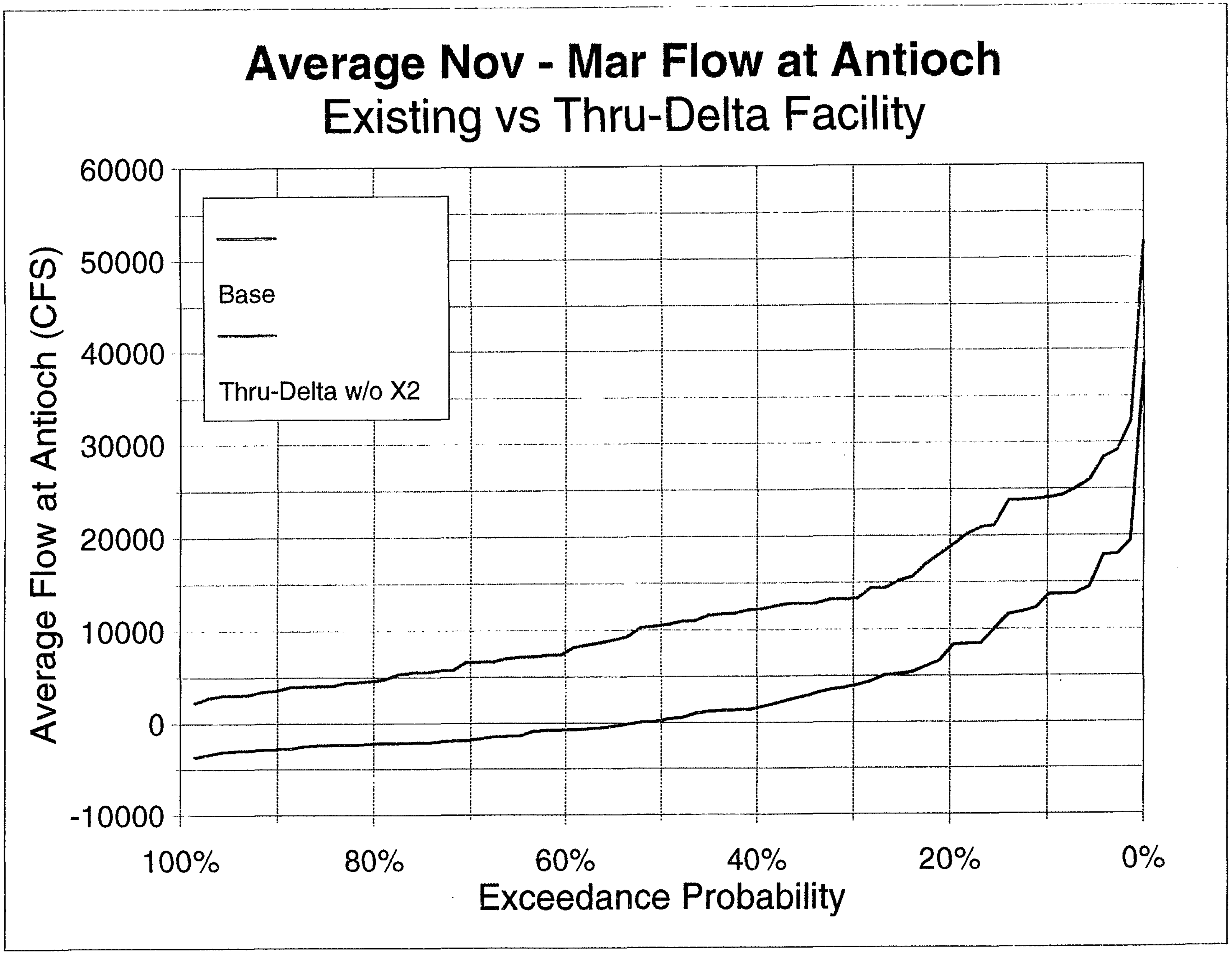
Figure 20:



D—007633

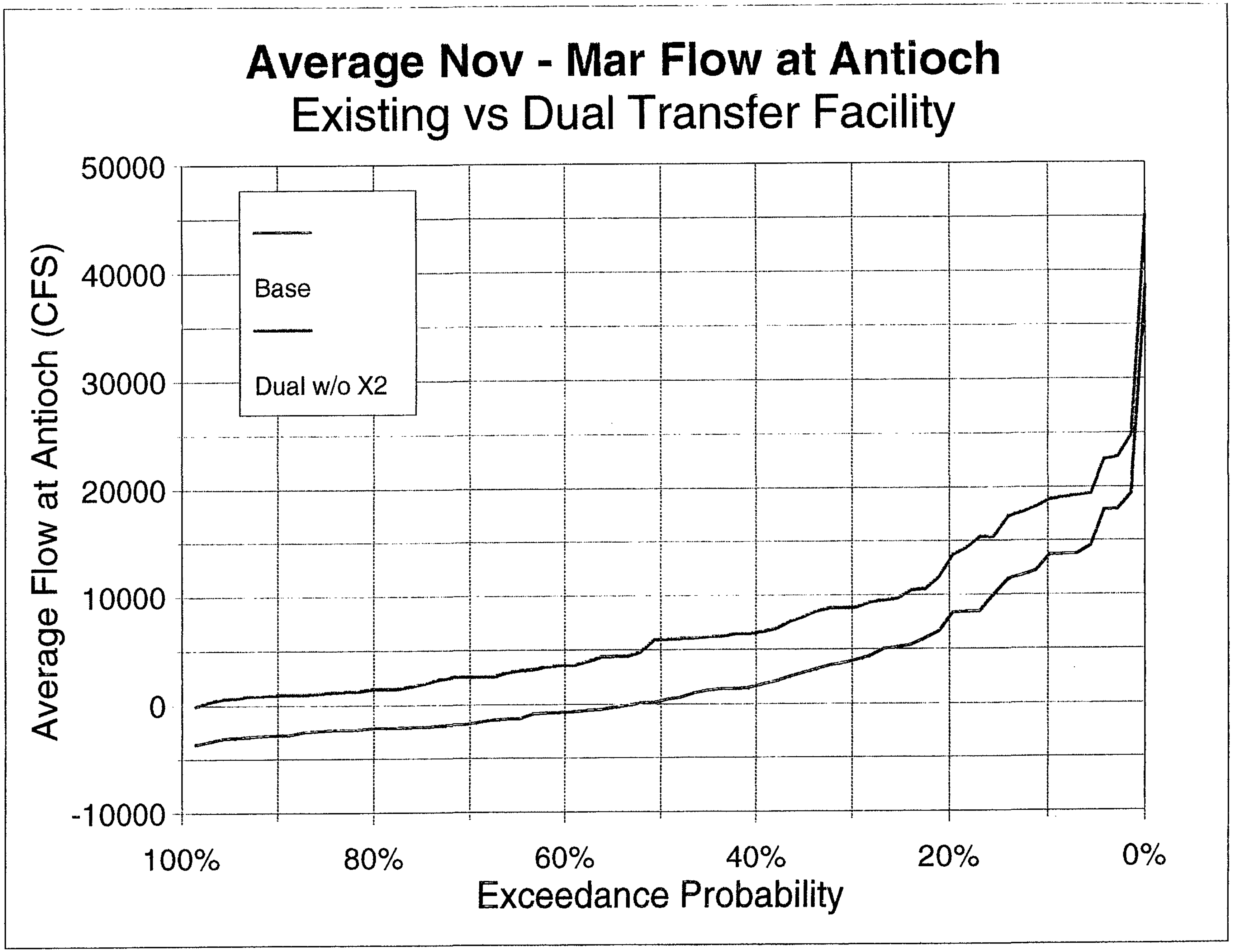
Figure 21:

D-007634



D-007634

Figure 22:



Average Nov - Mar Flow at Antioch
Existing vs Dual Transfer Facility
Average Flow at Antioch (CFS)
50000
40000
30000
20000
10000
0
-10000
Base
Dual w/o X2
100%
80%
60%
40%
20%
0%
Exceedance Probability